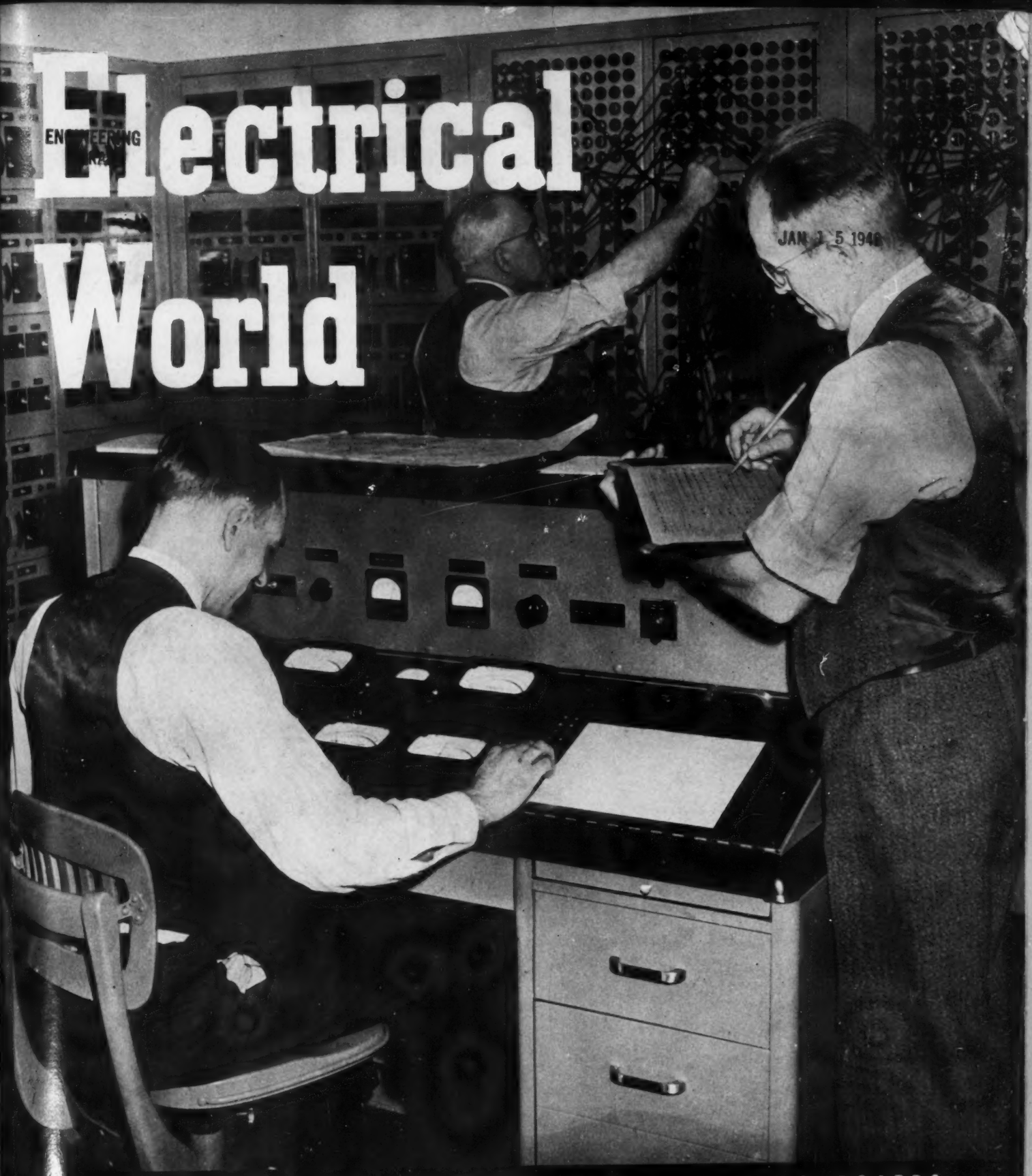
ENGINEERING

Electrical World

JAN 1 5 1946



UTILITIES PLAN SYSTEM EVOLUTION ON CALCULATING BOARDS

All-Industry Approach to Commercial Lighting

Post-War Substation Designs Incorporate War-Time Expedients

January 5, 1946

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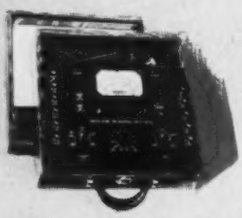

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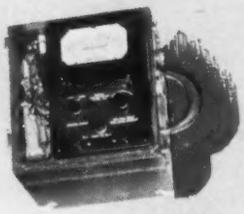

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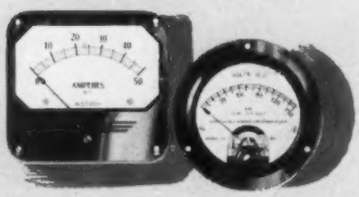

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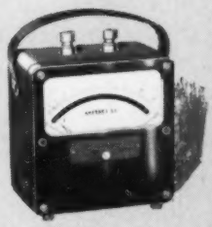

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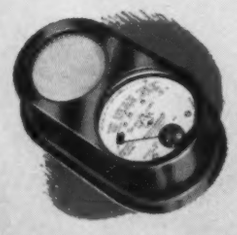

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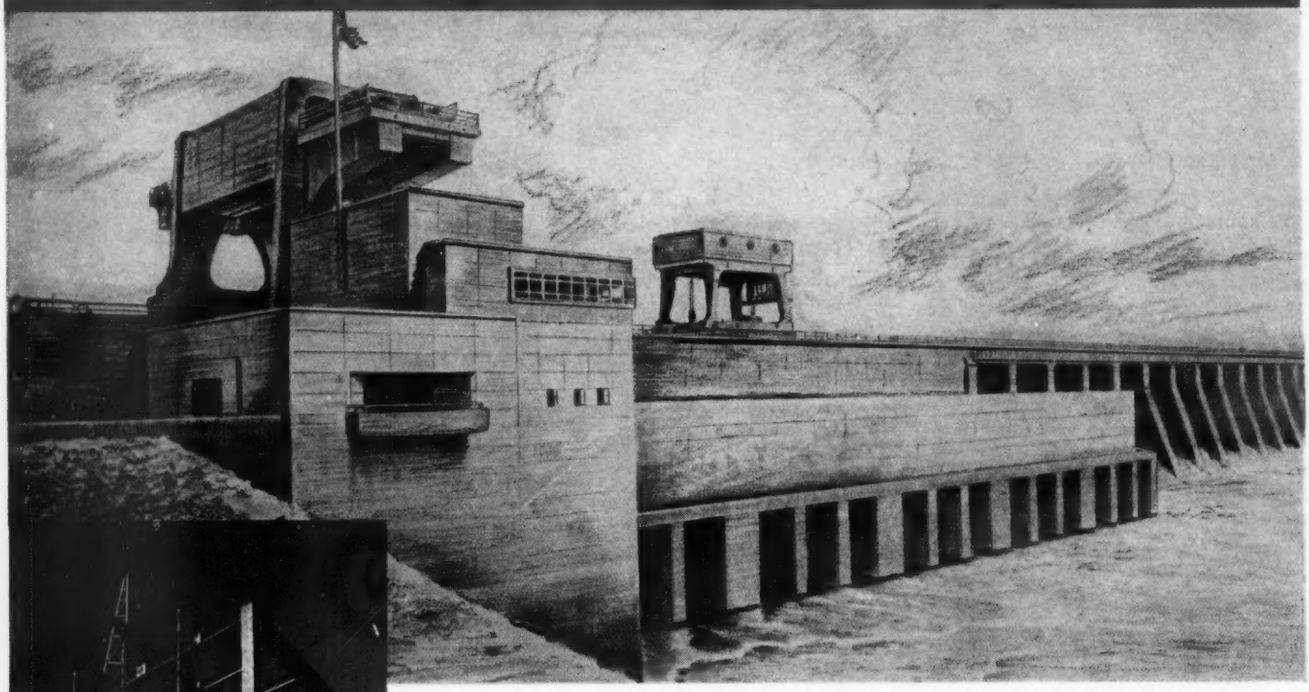
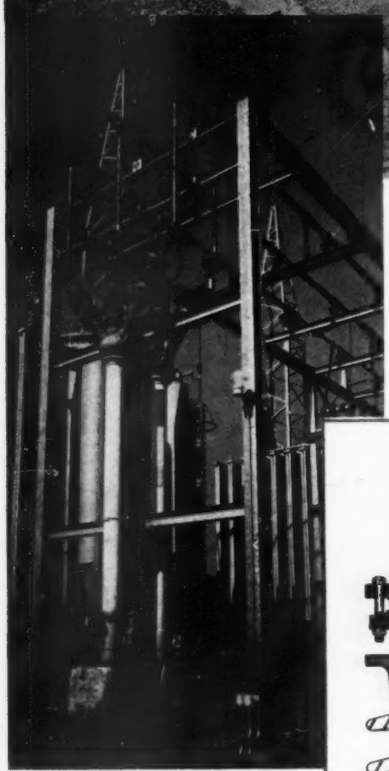
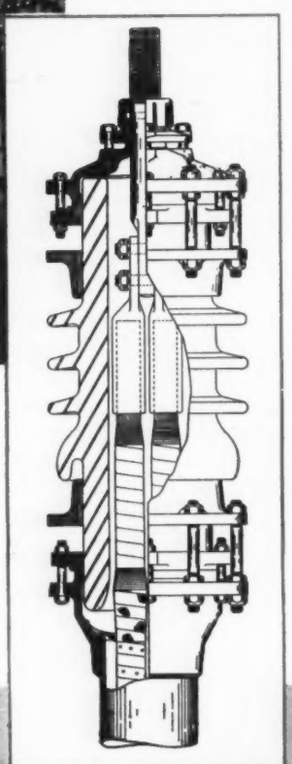
TVA SAVED SPACE, MATERIAL WITH OILOSTATIC CABLE INSTALLATION





Terminating structure of 13.8 kv Oilostatic Generator leads in transformer yard at Kentucky Dam, showing trifurcating terminal on pipe.

Each pothead contains a pair of 1,500,000 CM conductors, a space and material saving Oilostatic design feature for this application.



SECTION OF TVA's OILOSTATIC SYSTEM

At the Wilson Dam near Muscle Shoals, Ala., and the new Kentucky Dam near Paducah, TVA engineers encountered similar problems and solved them by the use of an Oilostatic System. At both these TVA dams, transformers are located at considerable distance from generators, and in both installations cable passes through congested sections containing vital station equipment.

Along with the desire to save copper and eliminate lead sheaths, these considerations pointed to a continuous copper conductor of minimum cross section, a compact arrangement and a strong mechanical enclosure for the generator leads. This combination was found in Oilostatic in which oil-impregnated, paper-insulated cables are installed in steel pipes filled with oil at 200 p. s. i.

At Wilson Dam, the installation consists of 2 three-phase circuits up to 1670 feet in length, each phase consisting of a pair of 1,000,000 CM concentric strand shielded paper-insulated cables, all 6 cables being enclosed in a 7" o. d. steel pipe. At Kentucky Dam, there are 5 three-phase circuits up to 910 feet in length, each phase consisting of a pair of 1,500,000 CM compact segmental strand, shielded paper-insulated cables, all 6 cables being enclosed in a 8⅝" o. d. steel pipe.

Oilostatic Systems, using ruggedly-built and carefully engineered Okonite-Callender cables offer not only a simple, economical way of handling heavy loads at high voltages, but a method that is widely applicable. Oilostatic Systems are also suitable for underground electrical transmission in congested or restricted areas, for tie lines, for crossing swamps and rivers, for eliminating overhead construction near airports, in tunnels and on bridges.

Write for literature which describes the Oilostatic Electric Transmission System in detail with illustrations and diagrams of its operation. The Okonite Company, Passaic, N. J.

OKONITE-CALLENDER
paper insulated power cables

4351

INCENTIVES FURNISH THE DRIVE

THE COMING YEAR, 1946, and the years to follow can bring unprecedented prosperity to the people of the United States if the incentives to secure it are provided.

We have the advantage of starting with an economy which has demonstrated a capacity for expansion unequalled in any other country in the world. Our economy has demonstrated, also, one grave weakness—a recurring interruption of the upward trend of production and living standards by wasteful and paralyzing periods of recession. Recovery from each depression always has carried us to new heights of economic welfare, but the toll of the years of blight has been harmful to everyone.

The job ahead of us is a dual one. We must maintain the vitality of an economy which, over the years, has yielded an enormous increase in the American standard of living, and we also must improve its stability.

The Dynamics of American Production

In the last prewar year, 1940, the population of the United States was 3⅓ times as large as it was in 1870. But the national production, measured in dollars of constant purchasing power, was 10 times as large at the end of the period, and industrial output had increased 20-fold.

In the meantime, the average number of hours of factory workers had been reduced from about 63 per week in 1870 to less than 40 in 1940, while average hourly earnings had more than trebled in dollars of constant purchasing power. Thus "real" weekly or annual wages in manufacturing had doubled over the 70-year period, even though the work-week was cut by 35 per cent. This was made possible chiefly by a tremendous increase in the quantity and quality of the mechanical facilities which were provided in American manufacturing industry. Manufacturing capital investment per worker was multiplied by 6 times over the period in question. But the return per dollar invested, while it has fluctuated widely between good years and bad, showed no general upward trend over that portion of the period for which measurement is practicable.

Incentives in American Manufacturing

There has been, historically, a remarkably consistent pattern in the division of the realized income from the expanding manufacturing output of America. Reliable statistics are not available for as far back as 1870, but from 1899 through 1939 the average share of wages and salaries has been 82½ per cent against 17½ per cent as the share to investors (including dividends, interest, rents, royalties, and non-corporate profits). There have been, from year to year, relatively minor divergences from this pattern of distribution, but there is no discernible trend during the period away from the averages cited.

It is suggested that the persistence of the average 17½ per cent share of realized income from manufacturing that was maintained for the 40 years preceding World War II may represent the proportion that is needed to produce the dividends, interest, rents, royalties, and non-corporate return that will provide for the continuing investment upon which an expanding productivity such as we have had in the past depends. At any rate, it would seem reckless to depart too radically from such an established pattern at a time when unprecedentedly large private capital investment is counted on to make up for the drastic curtailment of such investment during the war years, and to carry us to the new high levels of civilian production set as our postwar goals.

The Distribution of Manufacturing Income in War

At the beginning of the war, the Government adopted controls and a tax program designed to prevent wartime activity from resulting in un-

duly swollen private returns. Due primarily to huge volumes, the profits *before* taxes of manufacturing industry were very high, but throughout the war its profits *after* taxes averaged returns no larger than they had been in good prewar years. Relative to volume, they were considerably lower than in prosperous years in the past. Again, there can be no complaint at results that generally were in accord with a national wartime policy.

But it is fair to note that the wages of manufacturing labor were allowed to increase substantially during the war. Between January 1, 1941 and April, 1945, average weekly earnings per worker increased by 77 per cent. This was, in considerable part, a result of increased working hours and a shift from low- to high-paid industries, but straight-time hourly earnings on the same jobs increased about 40 per cent against a cost-of-living rise of about 30 per cent.

The net result was to alter drastically the 40-year relationship of the 17½-82½ per cent division of Realized Income from Manufacturing. The share of wages and salaries increased to over 90 per cent, and the investment share shrunk to less than 10 per cent.

Its Postwar Distribution

This wartime shift in the proportion of distributive shares has an important bearing upon current wage controveries. With union demands for wage increases ranging up to 30 per cent, and the economists of the Office of War Mobilization and Reconversion asserting that an average increase of 24 per cent is feasible without raising prices, it is pertinent to inquire how such increases would affect the prewar ratios that governed realized income distribution in manufacturing.

Forecasting is always hazardous, but if we assume (1) that in 1946 we shall reach the $160 billion level of national output which the Government proponents of general wage increases expect, and (2) that there will be little increase in productivity because of the continuing process of reconversion, and (3) that the Government will succeed in carrying its announced purpose to maintain present price ceilings, it appears that a 24 per cent general wage increase would reduce the share going to capital from 17½ per cent to 11 per cent even allowing for its increased return resulting from the repeal of the excess profits tax. The prewar ratios would be about maintained if wages remained at present levels.

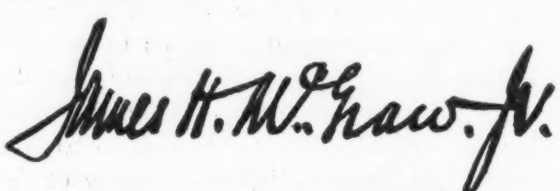
Conclusion

Since the maintenance of these prewar ratios was accompanied by an unparalleled rise in the "real wage" of American workers, there is a powerful prima facie case for not tinkering with them. It should be noted, however, that some economists think that the size of the investment share of manufacturing income tends to provide more capital than can be absorbed by a mature economy, and thus contributes to those breaks in the expansion of the economy which, as stated at the outset, have been its principal blight.

Regardless of what may ultimately prove to be the validity of this view, no one can responsibly contend that at this early but crucial stage in the reconversion process is the time to test it. Now, no one knows whether, or what dimension of, additional wage increases can be supported without forcing up prices or reducing profits to a point that will discourage vitally needed private capital investment.

We want high and increasing wages in American manufacturing. We need them to provide an active incentive to workers to support expanding productivity, as well as to continue the trend of rising living standards in America. Equally, we need a continuing profit incentive of sufficient attractiveness to call forth the new investment upon which expanding productivity depends.

We can never attain our dual objective if we push one of these aims so far and so fast that it defeats the other.



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Electrical World

JANUARY 5, 1946

The First Year of Peace

ALMOST for the first time since the crash in 1929 does a new year begin without the restraining hand of war or depression to limit it. It is the year the world has looked forward to. We only hope that it is not disappointing.

For some time there is bound to be an aftermath of war that will hinder progress, but long before the year is over much of this will have disappeared. One by one the little log jams that are holding back production will be broken and then it won't take long to get into full stride. Outside of labor and inflation, most of our worries are little more than irritations that will give way to patience.

On the labor front, it would not be stretching the imagination to predict that 1946 may easily be the year of greatest progress and that out of these current disturbances may come policies and practices which, if lived up to, can be the start of a new prosperity in the world's last stronghold of free enterprise. If, in return for an improved wage, labor is willing to give improved productivity, then we need not fear inflation.

To the electrical industry this all offers great opportunity. Great as was the demand for electrical products and energy during the war, the demands of peace will be greater. Judging by today's conditions, it would not be surprising to find the year ending with new peaks in the production of power and power equipment.

Expansion, therefore, can be looked for in both the power and manufacturing branches of the electrical industry. In fact, if materials and manpower can be had as needed, there is every reason to believe that the power branch will expand as much if not more than it has in any other year. Nor is this just a flash in the pan, as was experienced in 1930, for several companies have announced a program of expansion to be carried out over a term of years.

The acquisition of new manufacturing plant without abandoning any of the old gives promise of equipment and appliance production beyond anything in the past, while manufacturers new to the field will further increase the volume.

Before the year closes a new shortage may develop which can easily become the industry's No. 1 bottleneck—trained sales personnel, Regardless of the apparently insatiable demand today for all kinds of electrical products, the buyer will be back in the saddle before long and goods will have to be sold.

Many new products are known to be ready for the market but there is a noticeable tendency to keep them out of production until there is more assurance that deliveries will not be held up. By the close of the year, however, a very marked increase in new offerings should be apparent.

Everything points, therefore, to the first year of peace not only as one full to overflowing for the electrical industry, but as one of opportunity for those seeking a career. Perhaps engineering schools will sense this and not let the glamor of high frequency rob their students of their birthright in 60 cycle.

Perhaps it is not right to speak only of the advantages the year has to offer without reciting the probable unfavorable aspects, but today, with all its confusion, we are more in need of vision. Of course, there will be problems, some of them major, with which the industry will have to wrestle. None of them, however, should dim the prospect of the great things the first few years of peace have in store for this industry.

Today's Network Calculators Will Plan Tomorrow's Systems

A survey and listing of a.c. network calculating boards—An interpretation of the calculating board as an engineering tool for sound evolution of systems, equipments and operating procedures—Discussion of scope, accuracy, conversions and limitations

DAN BRAYMER, Western Editor, "Electrical World," Chicago, Ill.

WAR HAS BROUGHT new eminence to the a.c. network calculating board. Already ten years old and firmly established as a vital tool in the solution of power system problems when hostilities began in Europe in 1939, the calculating board emerges today as the scientific implement responsible for the tremendous war-time achievement of power systems in this country. Time and again board studies have proved that vital war loads could be carried on already burdened facilities without requiring new generating capacity, substations or transformers. The abundance of power available for America's war machine has not been a "happenstance." It has been due, in no small measure, to the elaborate power system interconnections tested and proved feasible in advance on the network calculating boards of the country.

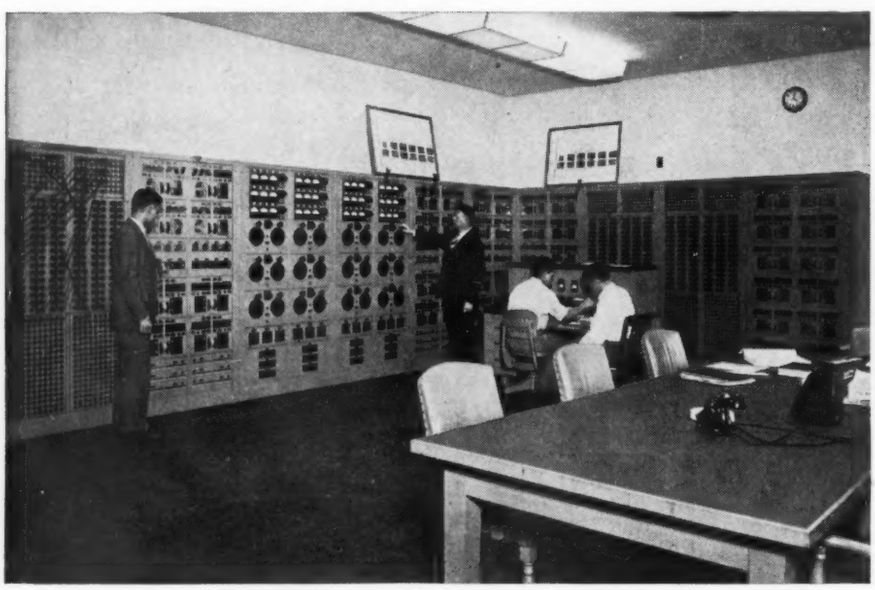
Power systems today face an era of expansion, post-war, in which system investigations will be more than ever needed to point the way. Yet a.c. calculating boards remain an enigma to many—mystical machines from which answers to all problems are wrung by professors, doctors of philosophy and myopic mathematicians.

True, a calculating board is no substitute for brains and must be operated by engineers who can recognize a problem, plan, analyze and carry through its investigation. Yet neither is it a witch's cauldron in engineering guise yielding up neatly typed answers to incredible problems. A calculating board will solve a wide range of problems, yet it has distinct and definable limitations that will be established later on.

A Calculating Device

Basically an a.c. network calculator is a computing device—a calculating table upon which variable resistors, reactors and capacitors can be arranged and combined in an electrical circuit having the equivalent characteristics of an actual power system, consisting of generators, lines, transformers, loads, etc.

Its use requires the same data on



NEWEST CALCULATING BOARD is the one (above) at Armour Research Foundation of Illinois Institute of Technology which was dedicated during June. Seventeen midwestern companies including eleven utilities will share in its use

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15.	A & M College of Texas	College Sta.
16.	Dept. Water and Power	Los Angeles
17.	University of Kansas	Lawrence

* = Equipped with load adjusters
** = Eight high resistor-reactor units
# = Has two master instrument desks
† = Purdue University in 1942 acquired the original West-

the rating, impedance and loading of generators, lines and apparatus and the same knowledge of theory needed for mathematical calculation of a network problem. But instead of computing the range of vector equations graphically, or by complex algebra in Kirchhoff law or trial and error solutions, the balanced three-phase system under study is represented on the calculating board by an equivalent single-phase circuit and desired voltage, current, power, and phase-angle determinations made for specified conditions by direct measurement.

Where unbalanced conditions are involved, single-phase networks representing positive, negative and zero sequence components of symmetrical coordinates are employed. Thus the advantage of the calculator lies in the ease and speed with which solution to network problems may be obtained. The time saving over mathematical methods is said to average about 400 to 1. The virtue of the network calculator, then, remains not so much in its ability to do the impossible as in doing the theoretically possible with greater dispatch. The board, however, does solve many problems that are *practically* impossible to calculate due to the many unknown factors required to set up proper formulas.

To set up the equivalent circuit or network on the a.c. calculating board, circuit elements or "units" are provided in varying numbers for different boards, as shown in Table I, depending on the scope and nature of the problems that particular board will be called upon to solve.

These units consist of adjustable resistors, reactors, capacitors, phase-shifters, and coupling transformers arranged in various combinations to represent generating stations or units, transmission lines, loads, synchronous or static condensers, ratio changing transformers and the like in the equivalent network. The nature and function of these various components is given in outline in Table II.

Four Problem Types

A. C. network calculators have been used for four general classes of problems: (1) normal system studies, (2) short circuit analysis, (3) stability studies, and (4) apparatus and circuit problems.

The most common problems of each group have been listed by H. A. Travers* as follows:

Normal System Studies

1. Circuit loading—both kw. and kvars.
2. Bus voltages.
3. Corrective condenser capacity needed to improve power factor or voltage conditions.
4. Optimum rating of transformers.
5. Tap range of transformers.
6. Improvements derived from load-ratio control equipments.
7. Improvements derived from quadrature control.
8. Optimum location of new generation facilities.
9. Effect of new transmission circuits.
10. Effect of rearranging existing circuits.
11. Best location of new substation; bus or feeder reactors.
12. Effect of change in system loading.
13. Effect of changed transformer reactance.
14. Effect of temporary loss of transmission circuits.
15. Effect of temporary loss of generation.
16. Improvements from changed system voltages; or conductor sizes.

Short Circuit Analysis

1. Determination of maximum short-circuit values for circuit breaker interruption duty.
2. Bus voltage during short circuit at point remote from fault to give measure of system performance under fault conditions.
3. Maximum and minimum fault currents and voltages for relay settings to give best selective action.
4. Determination of optimum values for neutral-grounding devices.
5. Maximum and minimum fault currents for proper application of transmission line protector tubes.
6. Effect of mutual coupling between parallel circuits, on short-circuit current and voltage values.
7. Effect of zero-sequence voltages and currents on ground relays and inductive coordination problems.

Stability Studies

1. Steady state limits.
2. Transient limits for various types of faults.
3. Optimum switching time for various types of faults.

* "The Network Calculator Brought Up to Date" —H. A. Travers *Westinghouse Engineer*—July, 1944.

TABLE I—A. C. CALCULATING BOARDS EXISTING AND ON ORDER

(2) Date	(3) Frequency	(4) Generator Units	(5) Line Units	(6) Load Units	(7) Special Reactance Units	(8) Capacitance Units	(9) Auto Transformer Units	(10) Coupling Transformer Units	(11) Total Units	(12) Name of Man In Charge	(13) Title of Man in Charge	Does Company Have A d.c. Board
1929	60	16	80	40	6	55	12	0	209	A. E. Fitzgerald.....	Assoc. Prof. Elect. Eng	No
1929†	440	12	160	40*	38(1)	40	24	30	344	J. B. Ward.....	Board Engineer	
1942	440	4	...	...	...	20	12	3	39	J. R. Eaton.....	Supt. Network Analyzer Lab.	Yes
1932	440	6	168	40	40	12	14	16	296	Operated by Gibbs & Hill, Inc.		No
1932	440	6	72	48	12	24	18	6	186	A. J. Krupy.....	Senior Engineer	Yes
1937	480	12	150	50	2	64(6)	20	15	313	N. H. Meyers, N. R. Schultz.....	Analytical Div. Cent. Station Engineering Division	Yes
1938	480	8	85	30	0	18	10	12	163	Hollis K. Sels.....	Trans. and Dist. Engineer	Yes
1938	440	12	60	20	8**	16	12	10	138			
1941	440	6	60	24*	0	18	12	12	132	V. J. Cisna.....	Electrical Engineer	Yes
1939	480	9	50	30	9	30	6	6	140			
1945	480	9	80	40	3	30	14	10	186	B. V. Hoard.....	Chief A. C. Calculator Board Studies Unit	No
1940	440	6	26	14*	14	12	6	12	90			
1941	440	6	52	18*	18	12	6	8	120	W. J. Lank.....	System Planning Engineer	No
1941	440	9	62	24*	24	24	12	8	163	G. D. Floyd.....	Consulting Engineer-Planning	Yes
1941	60	7	87(7)	30	21	26	14	0	185	W. E. Slemmer.....	Transm. and Dist. Engineer	No
1942†	440	18	152	48*	18	48	36	36	356	H. P. Peters.....	Engineer	Yes
1945	440	12	100	40*	30(2)	36	18	18	254	L. B. LeVesconte....	Supervisor & Chief Engineer	Yes
On Order(4)	440	18	150(3)	56*	18	54	24	24	326	M. C. Hughes..... L. M. Haupt.....	Head E. E. Dept. Professor E. E.	No
On Order	440	18	120	40*	21	36	16	18	269			
On Order	60	8	56	32*	11(5)	12	8(5)	6	133	Victor P. Hessler....	Chairman—E.E. Dept.	No

inghouse board which was built in 1929.
(1) = Includes 18 high-impedance units.
(2) = Comprises 12 special reactance units—18 metered jumpers.
(3) = Sixteen are "pi" line circuits to represent transmission lines.
(4) = To be equipped with transient analyzer.
(5) = Includes low-loss generator reactors.
(6) = Includes four high-susceptance units.
(7) = 63 of fixed value, 24 of adjustable value.

4. Improvements resulting from high-speed reclosing.

5. Effects of changing inertia (WR^2) of rotating apparatus and influence on stability limits.

6. Determination of increased system stability and load transfer over important tie lines caused by speed, three-pole or single-pole tripping and reclosing.

Apparatus and Circuit Problems

1. Optimum design characteristics for large synchronous motors remote from source of generation.

2. Best starting methods for large motors —effect on system voltages and pull-out of loaded running motors.

3. Solution of large or special low-voltage or primary networks.

4. Unbalanced current and voltages on three-phase system resulting from unsymmetrical loading.

5. Effects of large welding equipments on electric furnaces on system voltages and normal loading.

Scope and Accuracy

The normal system studies of group one encompass problems of design, extension and operation of power systems. These problems represent the broad range of work that can arise in preparing for and executing system extension and interconnection.

The short circuit studies of group two solved on d.c. calculating boards give an accuracy of 10 to 20 percent. Where this d.c. board is acceptable there is no need to burden the a.c. board with them unless accuracies of the order of two percent are sought, in which case only the a.c. network calculator will be necessary.

The d.c. board, while it may supply a satisfactory answer to short circuit problems, meets an insurmountable obstacle when phase angles are involved as they are in some relaying schemes and where neutral resistors or reactors are employed. Then the engineer must turn to the a.c. board where phase angle and magnitude of voltages and currents can be determined in their true relation and operation of the system predicted accurately.

Stability Studies

Stability studies listed in group three include problems of steady state load limits and mechanical swings of generators and loads following system disturbances. It is important to note here, however, that the a.c. network calculator is *not* to be confused with a transient analyzer. Every setting of the calculator must represent a steady-state condition of the network being investigated. While the calculator is not able to represent electromechanical transients directly (for stability studies) it can consider them as a succession of brief steady states and, proceeding step by step, can lead to solution of transient conditions. Being without rotating elements the a.c. calculating board is completely stable in itself regardless of phase angles between the generating units being represented. Thus it is admirably adapted to such step-by-step analysis of transient stability.

Limitations

Like everything else, however, an a.c. network calculator has limitations, as has already been pointed out. It cannot solve problems for which no theory of solution has been developed.

Accuracy of the calculator ranges from one to three percent. But this accuracy presupposes accurate basic data and assumptions.

The a.c. network calculator cannot be used to study electrical transients directly because, as has been stated, every setting of the board must represent a steady state condition of a network having fixed elements and subject to definite terminal conditions at generators and loads. For this reason it does not lend itself to study of corona or travelingwave type transients caused by switching operations or lightning. Only when a problem can be reduced to one of a succession of steady states can it be solved by the calculating board.

Moreover, the network calculator is limited to one frequency. If other than the fundamental frequency is to be considered, the network for each harmonic must be set up in the same way as for the fundamental; appropriate constants, connection diagram and terminal conditions must be specified completely.

Calculators Are Expensive

From the foregoing discussion it is evident that with the degree of complexity and accuracy of modern calculating boards, they could not be other than costly. Prices of most a.c. calculators range between $80,000 and $100,000. While this may prohibit acquisition and exclusive use by a single company, it has not been, nor need it be, a bar to increasing use of boards by smaller companies. The present tendency, as in the case of the newest a.c. network calculator recently installed at Armour Research Foundation of Illinois Institute of Technology, Chicago, is for some institution to purchase a calculating board and establish a cooperative plan under which power companies, consulting firms and others purchase board time on a unit basis. In the case of the Armour board, a unit of use permits use of the board for one week each year for 12 years by the 17 member companies cooperating. Non-member companies may also purchase time during specified periods, however.

Study Procedure

Procedure in making an a.c. network calculating board study breaks down conveniently into six steps as follows:

(1) Outline the nature of the system problems being studied, stating the operating condition of the system for each problem and the objectives sought and data to be determined.

(2) Prepare a one-line diagram of the system for each condition under investigation, showing all essential circuits. Indicate the impedance data for all circuit elements and also the rating and impedance data on all system apparatus involved.

(3) Convert system impedance values to per unit or percent on a common kva. base, such as 100,000 kva.

(4) Set up the network on the calculating board to agree with the one-line diagram. Load the board by adjusting the values of load impedance and generator output for the operating condition specified in the outline.

(5) Read the instruments indicating values of current, voltage, watts, vars, phase angle, etc.

(6) Convert the results to actual system values and analyze them to determine what system changes are required to meet desired objectives.

•

Value of Arresters

In the area of one regional association no operating company has yet found a means of satisfactorily determining whether or not lightning arresters have proven of value on transmission systems. The report says there is still some difficulty in ascertaining accurately whether the arresters have ever operated. One company believes arresters, nevertheless, to be a cheap form of protection (if properly applied) and most members agreed that, for 2 to 3 percent extra cost, installation of arresters was worth while.

Simplicity and Controls are Keynotes of Post-War Plant

Proficiency of equipment justifies coordinated and concentrated controls —Operating exigencies warrant new equipment dispositions—Instrumentation and automatic regulation facilitate efficiency—Potential merit considered to reside in reheat at higher temperatures

RALPH C. ROE, President, Burns & Roe, Inc., New York

IN THE FINAL ANALYSIS the most efficient operation is found in the plant where simplicity has been the keynote of design. Engineers and management are therefore concerned at the present time in reviewing the basic factors affecting power plant design in order that post-war plants shall not fail to realize new possibilities of economy, reliability and ease of operation.

Technical advance in the performance of boilers, turbines and auxiliaries has resulted from many new features of design, but these often in themselves involve additional complications; however, the overall accomplishment of these mechanical developments commonly permits greater simplicity of plant arrangement and operation. Consequently, while simplicity in plant design would seem to be an obvious aim, its actual accomplishment is a matter of considerable experience. For example automatic combustion control, which in itself involves a number of machine or instrument type regulators interconnected in a coordinated system of control, enables the plant designer to plan the arrangement of the entire boiler plant so that its operation becomes greatly simplified for the boiler room crew because of this automatic regulation.

Simplification of plant design can also be accomplished by focalizing the operational functions of the various machines in one or two central locations where the operator may be stationed. The driving units of different auxiliaries such as fans and pumps can be placed so that they are grouped within a limited floor space where supervision and routine maintenance can be furnished easily and with the least possible travel on the part of the operator. (Fig. 1).

Minimized Operating Force

Economic factors such as the scarcity and the cost of highly competent labor necessary for power plant operation together with the rising cost of fuels have for some time profoundly influenced the arrangement of plant equipment, the visual indicating and recording of operating conditions, and the automatic regulation of every possible control function. The improvement of fuel handling equipment with

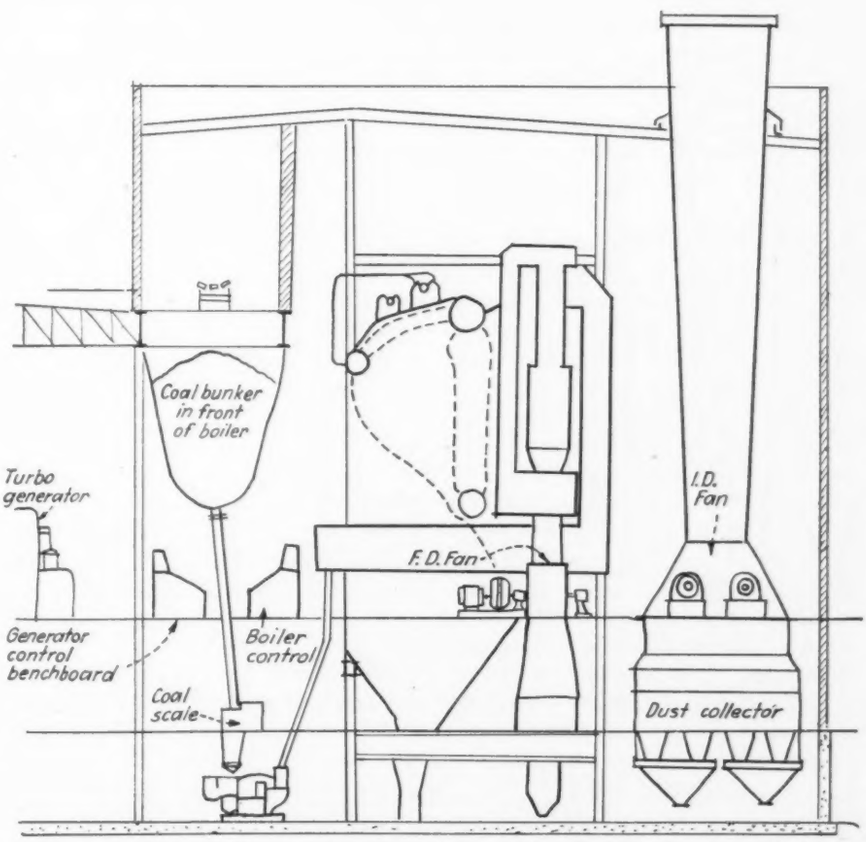

FIG. 1—Elevation showing location of important machines such as forced and induced draft fans on the main turbine and boiler operating floor along with conveniently centralized control boards for both turbines and boilers

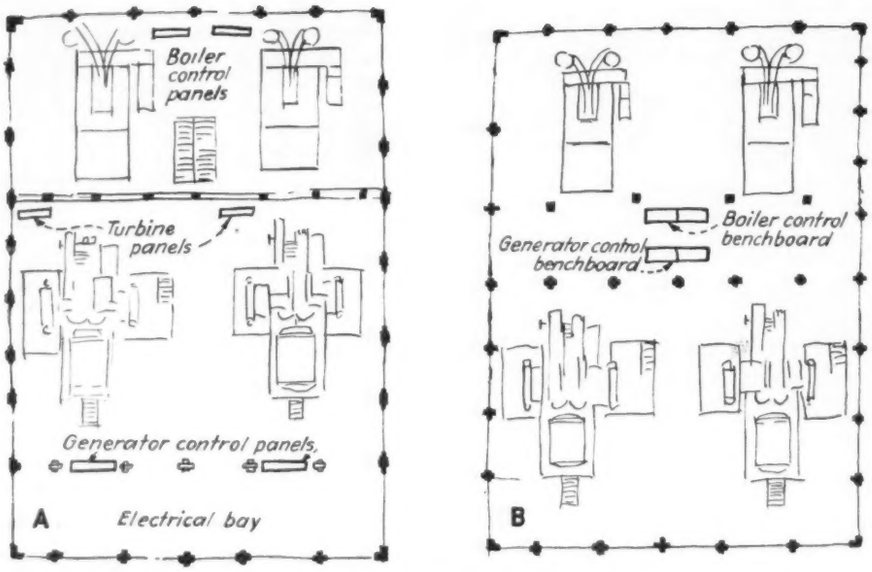

FIG. 2—Several benefits accrue from substituting improved arrangement for prior conventional arrangement

A. *Conventional Arrangement*

1. **Boiler room and turbine room separated by partition wall.**
2. **Boiler and turbine attendants are separate and distinct crews.**
3. **Instruments and controls are separate functional units accessible to only one group of operators.**
4. **Arrangement of machines laid out for convenience of each group of operators only.**

B. *Improved Arrangement*

1. **Boiler room and turbine room combined in a single area without partition.**
2. **Boiler and turbine attendants combined into one group and stationed in center of area occupied by boilers and turbines.**
3. **Instruments and controls centrally located and accessible to combined operating group.**
4. **Arrangement of machines so planned that regular supervision and maintenance is localized around center of total floor area.**

its attendant cleanliness of operation has made it possible to bring the steam generating and power generating equipment together in a more closely coordinated unit resulting in a substantial saving in manpower alone.

Plants are now in successful operation in which the boiler room and turbine room are combined in one large enclosure with correlated instrument and control panels located at the center. Means for remote manual control are brought to this centralized control point, thus limiting the territory to be covered by the individual operators and making it possible for a comparatively few men to operate the plant more efficiently than was formerly possible with larger crews in sectionalized plant arrangements. (Fig. 2).

Auxiliary equipment, such as forced and induced draft fans and fuel burning equipment requiring routine attention of the operators, is also located on the main operating floor and only such equipment as pulverizers, pumps, air compressors and similar equipment is located on the only other operating level which is in the basement, thus further conserving operating personnel. By consolidating all running machines on two levels in this way, the men who are responsible for their performance have less area to cover in their work and can therefore handle other duties. The net result is a saving in labor with no reduction in service to the equipment.

Centralized Control

Ability of the operators to perform their duties from a centralized point of control has become accepted procedure, largely because of the accuracy and reliability of modern indicating and recording instruments, and also the remarkable dependability of automatic control. The furnaces of some of our large boilers could not be successfully operated without automatic combustion control, which regulates the rate of fuel and air entering combustion in such accurately metered proportions and in such fine balance to load demand that boiler test efficiencies are substantially maintained in monthly averages.

These automatic control systems are already developed and in operation for the efficient combustion of two or more fuels having varying rates of availability, such as is found in steel plants where blast furnace gas, coke oven gas, and pulverized coal are used in combination as the supply of gaseous fuels fluctuate due to variations in mill production. These plants are automatically operated with small crews of only a small percentage of the number that would be required without such control and with far greater safety.

Two Objectives Attained

A power plant design which incorporates complete automatic control and a full complement of remote type indicating and recording instruments, all of which are located at a centralized control panel, accomplishes two main objectives.

In the first place the boilers are operated continuously at maximum efficiency at each load with greatly reduced physical effort on the part of the fireman and water tender. As a result these men are free to devote their full attention to the more essential duty of observing all operating conditions affecting the efficient combustion of the fuels and of making any necessary adjustments in the regulation of these conditions. The duties of these men, therefore, assume a more supervisory nature and this leads to more intelligent and efficient operators.

The second objective which is equally important and may be regarded as the complement of automatic regulation results from complete instrumentation of operating conditions. By the use of remote indicating and recording instruments, the operator standing before the centralized control panel (Fig. 3) is provided with a simultaneous visual record of the varying conditions at vital points in furnaces, boilers, firing equipment, ducts and steam mains. The operator no longer needs to make periodic trips to these points, often quite separated, for

observation of conditions, but remains at his centralized meter and control station.

Comprehensive Instrumentation

Multipoint gages accurately indicate the pressures and drafts from forced draft fan outlet through combustion chamber and the boiler passes to stack. Indicators show the level in boiler drums, condensate tanks and hotwell. Flow meters indicate and record the quantities of air, fuel and steam so correlated in certain types of meters that the operator can make quick interpretations of combustion efficiency. Furnace atmospheres are analyzed and recorded by CO_2 and O_2 meters providing the operator with a continuous knowledge of the action taking place in the combustion chamber.

Temperatures Relayed to Gages

Thermometers and thermocouples located at crucial points in the boilers and furnaces relay the temperatures at these points to gages on the control panel; and conductivity meters record the quality of the steam leaving the boiler.

Electronic devices which have already been utilized in the control of fan speeds will undoubtedly find a wider application not only in automatic control equipment, but also in meters and instruments of various types. The accurate metering of solid fuel in transit has been successfully accomplished in certain cases but will undoubtedly be improved and applied more generally.

War-Time Advance in Controls

Squadrons of multi-engined bombers each with a power plant of 2,000 to 3,000 hp. operated during the war with unprecedented precision and dependability, largely as a result of astonishing advances in the design of instruments and control applied to operation as well as navigation. These developments are certain to bring still greater improvement in stationary power plant instrumentation and control.

The high reliability and availability of modern boilers and their accessories are resulting in an increasing tendency toward unit installations, that is, one boiler for each turbine, with little or no interconnection between units except on the electrical end. This arrangement is a direct step toward simplicity of design and also simplicity of operation because electrical load variations can more readily be met by varying the rate of steam generation in a single integral unit boiler than in multiple control of several boilers operating in parallel.

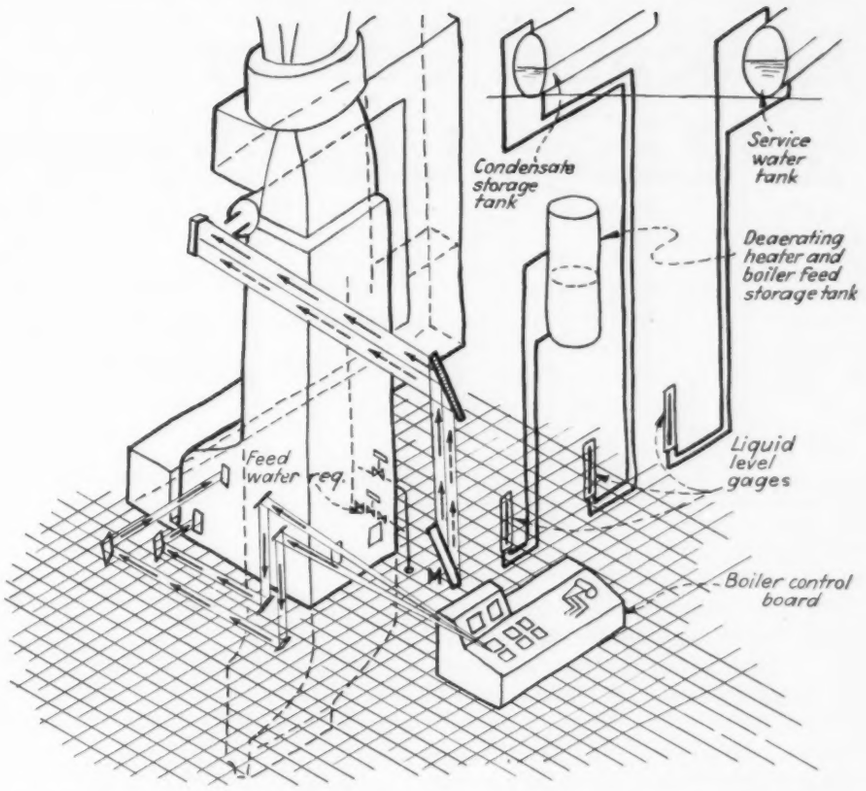

FIG. 3—Effectiveness of operating personnel may be more fully realized where visual indication of vital operating conditions such as liquid levels and temperatures are transmitted by mirrors (M) or remote indicators to a central control board. This insures greater reliability as well as safety of operation

Fluids for Reheat

Reheating of turbine bleed steam has increased efficiency under certain limited conditions. These conditions may be raised in future design by the development of reheat fluids which can be utilized at temperatures above the present 750 deg. F. limit—say 850 deg. F. to 1,000 deg. F. This development holds the promise of still greater simplicity and improved efficiency through the possibility of bringing the heat from the boiler to the turbine for immediate return of the reheated steam to the turbine rather than returning this steam to the boiler as is customary in present power plant design.

Thoughtful consideration of these many possibilities which now lie beyond the threshold of tomorrow's power plant design leads to the conclusion that greater simplicity and efficiency of operation through the medium of design and automatic regulation may be realized to a far greater degree by those utility system engineers preparing to enter into these new enterprises.

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Hyperbolic Cooling Towers

Each of the two new 30,000-kw. units at the Kilmarnock Generating Station of the (British) Ayrshire Electricity Board is served by a reinforced-concrete, natural-draft cooling tower of hyperbolic shape. As described in the *Electrical Review*, each will deal with 250,000 cu. ft. of water per hour, cooling from 87.5 deg. F. to 75 deg. F. with a dry-bulb temperature of 53 deg. F. at 100 percent humidity. Make-up under the designed conditions is 0.81 percent of the water entering the tower per 12.5 deg. F. range of cooling.

Top, throat and base diameters are 87, 77, and 130 ft. respectively. Height above sill is 190 ft. and depth of pond below the sill is 10½ ft.

Personnel Carrier for Large Line Crews

Special bus may be used for line crews as solution to personnel transport problems where man-cab on truck proves inadequate—Can stay idle on the job or move to shift other crews to new locations

E. W. TEMPLIN and I. L. BATEMAN, Los Angeles Department of Water and Power*

ONE OF THE MANY current problems confronting utility engineers is that of transporting line crew personnel from headquarters to the field jobs and return. For many years there has been a justifiable demand for a better place for the crews to ride than in the body of a line truck, especially when the men are cold and wet. The Los Angeles Department of Water and Power, with long experience in electric and water utility operation, has satisfactorily worked out some of the problems of adequate crew transportation on the system.

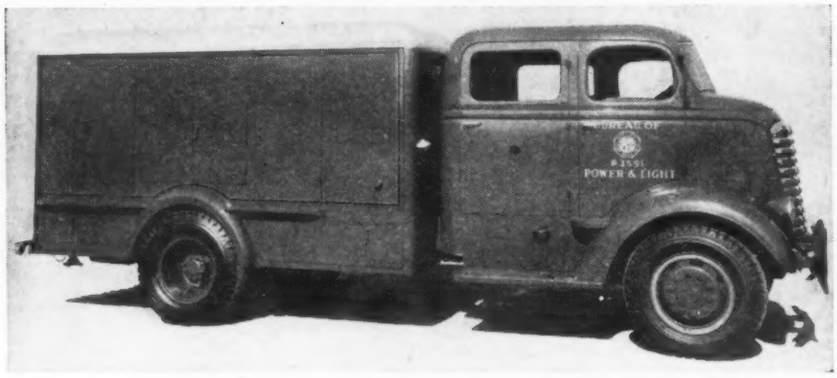


FIG. 1—Line truck with "full-crew" factory built cab provides for crew of five or six

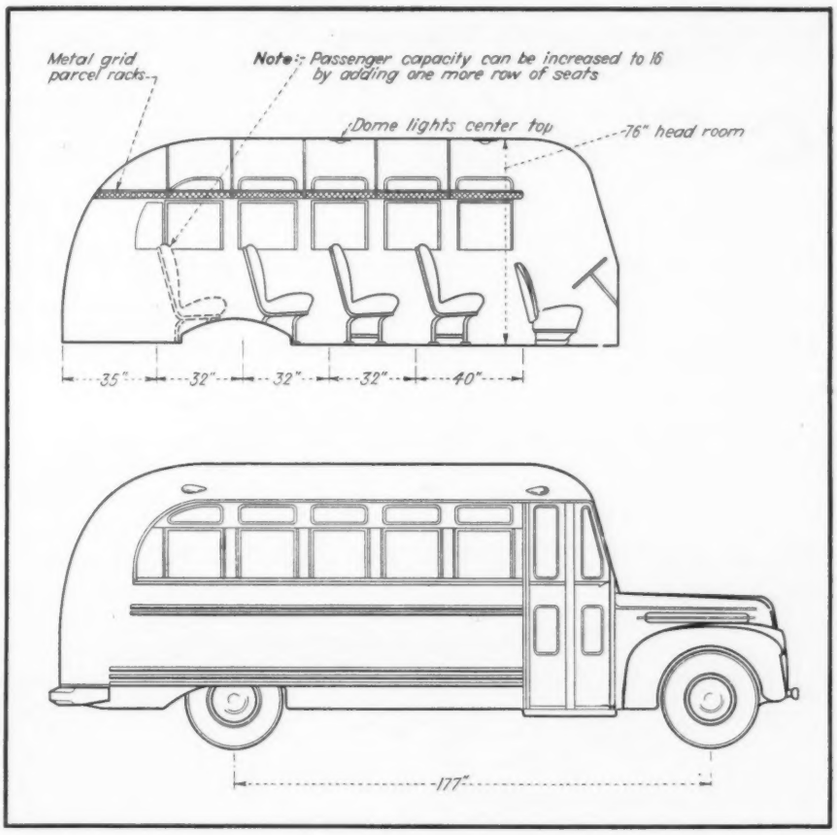
Full-crew Cab

One of the steps for providing more comfortable riding facilities for workmen has been the full-crew type of cab as shown in Fig. 1. This truck has a very satisfactorily built cab, but has the objectionable features that it not only increases the first cost of the chassis by approximately $400, but ironically enough it penalizes the owner on turn-in, because the buyer has to deduct about $200 from the market price of a standard chassis of the same type to cover the cost of cutting down the cab. Moreover, this type of cab, seating two men in the driving compartment and four in the extra seat, provides for a gang of only six men, including the driver, and is not adequate for larger crews.

The first objection, that of cost, may be overcome by taking the next logical step, that of providing a seat at the front of a line truck body, as shown

FIG. 2—Compartment built into front end of line truck body seats four, plus two in driving compartment for crew of six. Power take-off winch under seat

* Automotive Engineer and Engineer of Transportation, Distribution and Communication, respectively.



PERSONNEL CARRIER which will solve the problem of transporting line crews of ten to twelve men and provide space for tools, tool boxes and work clothes

in Fig. 2. Except for some mechanical problems introduced by this design, it has proven quite satisfactory for small gangs. The space taken up by the cab is so designed that the winch is placed below the seats, thus conserving valuable space.

Although, as stated, this body has proven satisfactory for small crews, it is not the final solution, because the department has many crews of ten to twelve men. Loss of space in the truck body, quite obviously, makes it impracticable to provide further personnel carrying capacity on the truck itself.

In the past years, the department has frequently used passenger cars or pick-ups in conjunction with the line crew trucks to provide adequate transportation for the men, and to provide some light transportation for the foreman and small amounts of material on the jobs. This arrangement provides flexibility but is not economical from an equipment or cost standpoint. For transporting crews of ten or twelve men, of which the department has a number, there is no adequate economical means other than the use of separate special purpose unit.

One that appears to meet the department's specifications is the Crown Body and Coach Co.'s body as shown by their drawing illustrated. This unit is simply a small bus that will go on a 1½-ton truck chassis to seat twelve men and driver. It has full head room, baggage racks for hand tools and work clothes and adequate space in the rear for tool boxes, heavy tools and wall space for hanging clothing. Small distribution transformers and other light equipment may also be carried. The estimated cost of this unit is between $3,500 and $4,000.

Flexible Movements

This type of bus may stay on the job with the crew, or frequently will be used to shift men from one job to another to obtain maximum working efficiency. This is a big advantage in an area as large as the city of Los Angeles where it is frequently necessary to shift men many miles from one district headquarters to another for a day's work or more. This flexibility is well worth considering.

It should be recognized, of course, that this special personnel carrier can only be justified on large utility properties.

Transfer Coefficients for Heat Exchangers

Efforts to improve the performance of intercoolers for aviation superchargers have led to some further criteria for air-to-air heat-exchangers. Data for the beneficial effects (in terms of Reynolds Numbers) were reported in a recent A.S.M.E. aviation war conference paper by Messrs. F. H. Green and L. S. King of AiResearch Manufacturing Co., Los Angeles; the title was "The Influence of Tube Shape on Heat Transfer Coefficients in Air to Air Heat Exchangers."

It was found that flattened tubes maintained fully turbulent flow, and consequently a higher heat transfer coefficient at lower Reynolds number values than did round tubes. The addition of dimples to the flattened tubes maintained fully turbulent flow from the transition point and increased the heat transfer coefficient substantially. The addition of the dimples also improved the relation between heat transfer and pressure drop in the flattened tubes.

Turbulence and Transfer

Other conclusions reached were these:

1. Transition from laminar to turbulent flow extends over the Reynolds Number range from 2,000 to 8,000 for small round tubes. If the tubes are flattened the transition region extends only from 2,000 to 3,500 while if the flattened tubes are dimpled the transition takes place at 2,000.

2. For any given Reynolds number, flattening a round tube increases the heat transfer coefficient substantially, while dimpling the flattened tube increases the heat transfer coefficient to an even higher value. This statement also applies to equal weight flows of air since the Reynolds number for a tube of given perimeter at a given weight flow is not varied by flattening the tube or by dimpling it.

3. For the same air pressure drop, dimpled tubes have the same or higher heat transfer coefficient than round tubes while plain flattened tubes have a lower heat transfer coefficient, except at very low air pressure drops.

4. The use of dimpled tubes in supercharger intercoolers permits a reduction in the amount of cooling air required.

Calculating Voltage Drop In Industrial A. C. Circuits

Simplified graphical method for making voltage drop calculations in alternating current circuits correlates voltage drop, conductor size, circuit length and current with line impedance and power factor

LEONARD H. GUSSOW, Albert Kahn Associated Architects & Engineers, Detroit, Mich.*

A COMMON PROBLEM encountered in a.c. distribution design calculations is the determination of the proper size of conductor for a specified voltage drop, when circuit length and current are known. Surprisingly enough, few simple, direct methods of correlating these four factors have hitherto been evolved that take line impedance and load power factor into account and give results consistent with usual engineering data.

This article attempts to consider this problem from the viewpoint of the design engineer concerned with industrial distribution systems and presents an original method of solving it. Approach to the problem is graphic and qualitative, keeping mathematics to a minimum.

Certain limiting assumptions have been made to keep the discussion within the bounds of practical engineering:

1. The line or feeder is short enough so that at ordinary frequencies capacitance can be disregarded.

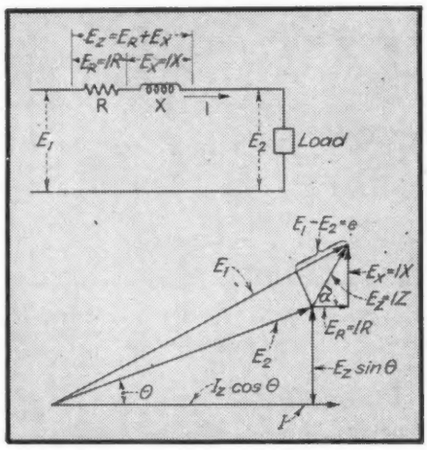
2. A single-phase circuit only will be considered:

3. Resistance and inductive reactance will be considered as lumped. Since these are series constants this does not affect accuracy.

4. Resistance and inductive reactance are assumed to be constants independent of temperature, line current and other factors.

5. Only lagging power factors are considered.

The exact analytical method for calculating the voltage drop $e = E_1 - E_2$ for the familiar vector diagram (shown) of a single-phase circuit is given in standard text-books. With other variables known, E_1 the sending ing voltage is determined by making two voltage resolutions, one in phase and one in quadrature with the current I.



VECTOR DIAGRAM for simple single-phase circuit with components

In phase	$E_2 \cos\theta + IR$
In quadrature:	$E_2 \sin\theta + IX$

$$E_1 = \sqrt{(E_2\cos\theta + IR)^2 + (E_2\sin\theta + IX)^2}$$

$$E_1 - E_2 = e =$$

$$\sqrt{(E_2\cos\theta + IR)^2 + (E_2\sin\theta + IX)^2} - E_2$$

While this formula will solve the vector diagram for a typical short line, it is tedious and the numerical quantities are such as to preclude accurate slide rule solution. Each problem must be worked out long hand.

Solution Cumbersome

Many attempts have been made to simplify this cumbersome equation. Most of the approximate solutions are too inaccurate for most engineering calculations. One approximation which can be shown to differ only minutely, in most cases, from the exact solution is:

$$E_1 - E_2 = e = I(R\cos\theta + X\sin\theta)$$

If in the expression for voltage drop, $e = I\ (R\cos\theta + X\sin\theta)$, R and X are the resistance and reactance, respectively, per 1,000 ft. of wire, then for a particular power factor, $\cos\theta$, the expression in parenthesis may be computed for each size of wire. This expression, called voltage drop factor "F" or voltage drop per ampere, is a constant for each size of wire and power factor. For any length of wire:

$$e = \frac{I \times F \times L}{1000}$$

I = the current in amperes, F = voltage drop factor, expressed in equivalent ohms per 1,000 ft., and L = length of conductor in feet. A nomogram for determining voltage drop by this formula will be described later.

Voltage drop factors F for single-conductor cable sizes are given in the table for several power factors. These factors have been computed on the following assumptions:

1. Cable is 600-volt, single-conductor, rubber and double braid in iron conduit.

2. Reactance is figured on a spacing equal to the cable diameter over the insulation, plus 10 per cent.

3. Based on experimental evidence, the reactance of cable sizes No. 1/0 and larger is increased 50 percent over the value computed in accordance with the above. This takes into account the increased spacing between wires in large conduit, and the greater leakage reactance resulting from the presence of iron.

4. Resistance is figured at an operating temperature of 60 deg. C.

* Electrical Engineer, now on military leave.

The accompanying graph of voltage drop factor vs. power factor for a few single single-conductor cable sizes in iron conduit reveals several notable factors. Voltage drop factor (voltage drop per ampere) for small conductor sizes is a maximum near unit power factor, decreasing with lower power factors. Conversely, for larger and larger conductor sizes maximum drop factor occurs at progressively lower power factors.

Equality of Phase Angle

Furthermore, it can be shown that the maximum voltage drop factor and therefore the maximum voltage drop for a given wire size occurs when line and load power factors are equal. Consider the vector diagram of a single-phase system in which load power factor is varied while current and load potential remain constant. Locus of the constant load potential E_2 is a quadrant of a circle. The impedance drop triangle is constant in magnitude and direction. Its magnitude depends on the constant current I. Its direction is determined by the line power factor and the fact that the resistance drop vector E_2 is parallel to I.

At 100 percent power factor, when E_2 and I are in phase, supply potential E_1 is only slightly larger than the numerical sum of E_2 and E_R. As the phase between E_2 and I increases and power factor decreases, a point is reached at which E_1 is exactly equal to the numerical sum of E_2 and E_x. This occurs only when the load phase angle, θ, is equal to the line phase angle, a.

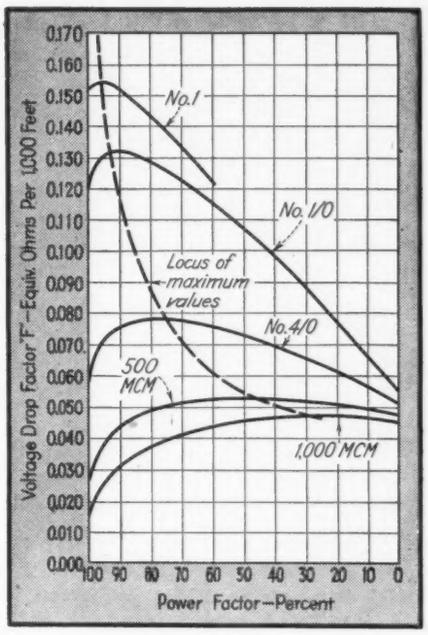
As the load phase angle increases further and power factor becomes less, a limit is reached when the phase angle is 90 deg. and when E_1 is only slightly larger than E_2 plus E_X.

Where θ equals a (load and line power factors are equal) the voltage drop "e" is equal to E_x. Since E_x is larger than either E_R or E_X the voltage drop "e" is a maximum for this unique condition.

Cable Power Factor

The extent to which voltage drop "e" decreases either side of the critical point where cable and load power factor are equal depends on the power factor of the cable, which is determined by the relative magnitude of R and X.

It will be noted from the curves of voltage drop factor that for the smaller conductor sizes the change in maximum



PLOT of voltage drop factor "F" vs. power factor for typical single-conductor cable sizes in iron conduit shows maximum voltage drop occurs at high power factor for smaller conductors; at low power factor for larger sizes

voltage drop factor is considerable for relatively small changes in conductor size. However, for larger sizes (500,000 cir. mil vs. 1,000,000 cir. mil) the maximum drop factor changes but little from one size to another. We shall examine the reason.

Voltage Drop Factor

Voltage drop factor F is: $R \cos \theta + X \sin \theta$. For small sizes of conductor the value of X is negligible compared to R, which varies with the wire size; therefore R is the preponderant factor influencing the magnitude of the voltage drop factor F. As inspection of the table will reveal, the conductor reactance X varies but little throughout the entire range of conductor sizes. Consequently in the larger conductor sizes where the effect of R on drop factor is diluted, voltage drop per ampere approaches a constant for all conductor sizes. This explains why it is accepted practice to parallel circuits above 500,000 cir. mil and so subdivide the total current rather than resort to a single circuit and the much larger conductor required to carry the same total current with comparable voltage drop.

Other Circuits

Voltage drop factors tabulated are for *single conductor* in any system of distribution. For a particular system, the factor for the voltage drop between any two conductors may be computed by adding the factors for the two conductors vectorially. Since usually the two conductors are of equal length it is only necessary to multiply the factor by a suitable number, based on the phase angle between the currents in the two conductors.

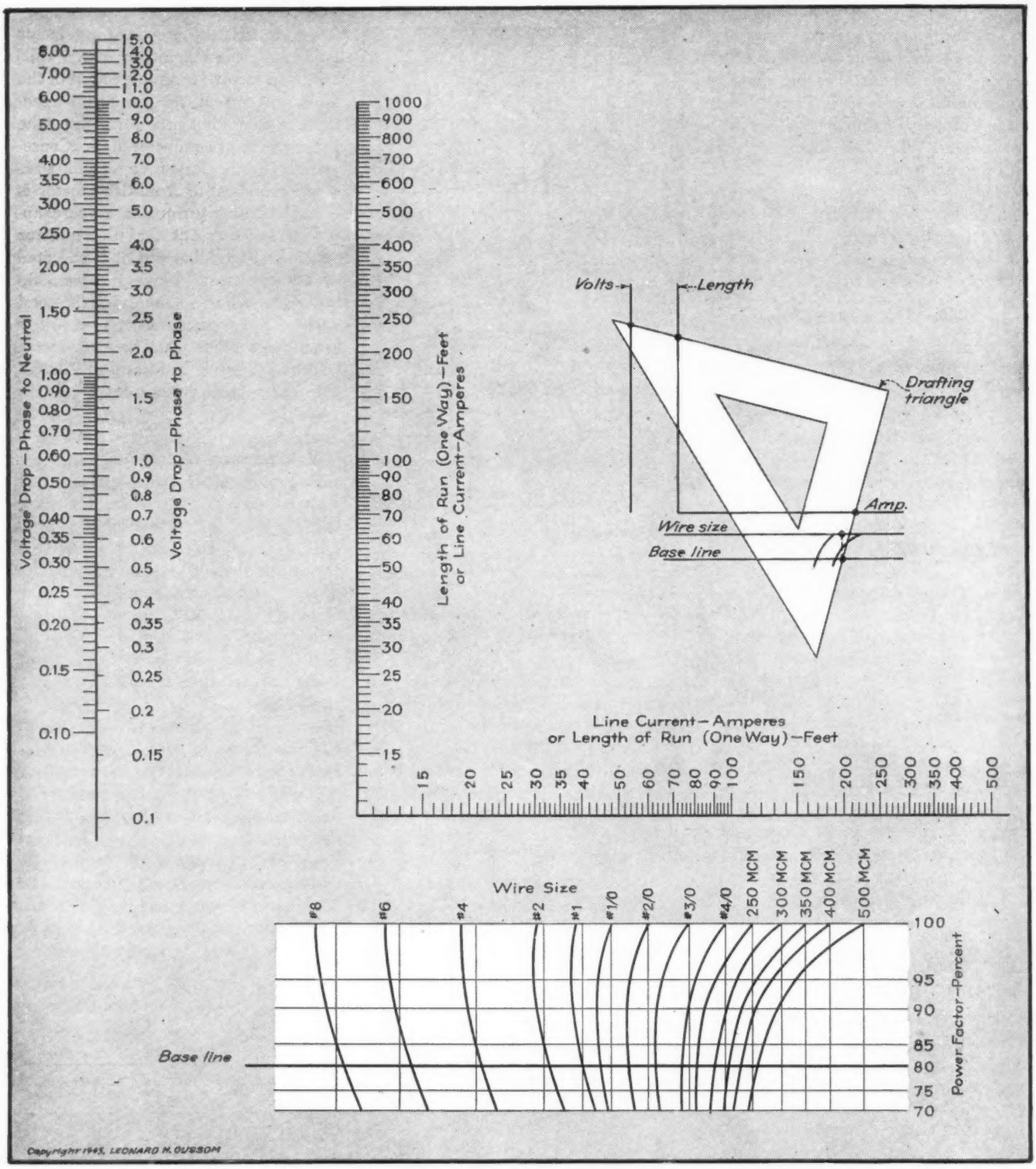
For a single-phase two-wire circuit, currents are equal and in phase. Factor for the system is twice the factor for one conductor. For single-phase 3-wire, balanced load, the neutral carries no current, currents in outside legs are equal and in phase. The drop factor for the outside legs are therefore the same as for a single phase, 2-wire circuit; drop factor between an outside leg and neutral is the same as the

Voltage Drop Factors

Equivalent ohms per 1,000 ft.—Single Conductor Cable In Iron Conduit

Wire Size	R/1000 60 deg. C.	X1000 60 cy.	Power Factor—Percent 100	95	90	85	80	75	70	Cable P.F.—%
14	3.024	0.0509	3.024	2.891	2.747	2.597	2.451	2.304	2.156	
12	1.901	0.0474	1.901	1.823	1.732	1.642	1.550	1.458	1.366	
10	1.196	0.0441	1.196	1.149	1.094	1.038	0.983	0.925	0.869	
8	0.745	0.0470	0.745	0.723	0.691	0.656	0.625	0.590	0.556	
6	0.482	0.0435	0.482	0.473	0.453	0.433	0.412	0.391	0.369	
4	0.303	0.0408	0.303	0.301	0.292	0.280	0.268	0.255	0.241	
2	0.191	0.0384	0.191	0.193	0.189	0.182	0.176	0.168	0.161	
1	0.151	0.0374	0.151	0.155	0.152	0.149	0.143	0.137	0.133	97
1/0	0.120	0.0545	0.120	0.131	0.132	0.131	0.129	0.126	0.123	91
2/0	0.095	0.0528	0.095	0.107	0.109	0.109	0.108	0.106	0.105	87
3/0	0.076	0.0515	0.076	0.088	0.090	0.091	0.091	0.091	0.090	83
4/0	0.059	0.0508	0.059	0.072	0.076	0.077	0.078	0.078	0.078	76
250M	0.051	0.0506	0.051	0.064	0.068	0.070	0.071	0.072	0.072	71
300M	0.043	0.0497	0.043	0.056	0.060	0.062	0.064	0.065	0.065	65
350M	0.037	0.0487	0.037	0.050	0.054	0.057	0.058	0.060	0.060	60
400M	0.032	0.0481	0.032	0.045	0.050	0.052	0.054	0.056	0.057	55
500M	0.026	0.0471	0.026	0.039	0.044	0.047	0.049	0.050	0.052	48
600M	0.022	0.0468	0.022	0.035	0.040	0.043	0.045	0.047	0.049	42
700M	0.019	0.0462	0.019	0.032	0.038	0.040	0.043	0.044	0.046	37
750M	0.017	0.0459	0.017	0.031	0.036	0.039	0.041	0.043	0.045	35
800M	0.016	0.0456	0.016	0.030	0.035	0.038	0.041	0.043	0.044	34
900M	0.015	0.0452	0.015	0.028	0.033	0.036	0.039	0.041	0.043	31
1,000M	0.013	0.0448	0.013	0.027	0.032	0.035	0.038	0.040	0.041	29

Above 100%



VOLTAGE DROP CHART for three-phase 60-cycle balanced load supplied by single conductor cables in iron conduit
EXAMPLE: *Known:* Wire size, power factor, length of run and line current as respectively; No. 2, 70 percent, 50 ft., and 90 amp. *Find:* Voltage drop. Extend vertical line to base line from intersection of 70 percent p.f. line and No. 2 conductor. Place triangle as shown with right edge intersecting 50 ft. and upper edge 90 amp. On upper edge read voltage drop at 1.25 volts

factor for a single conductor.

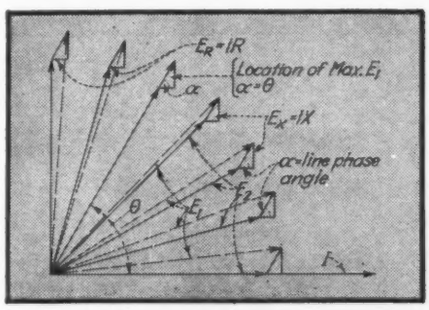
In a three-phase, 3-wire system, balanced load, the currents in any two wires are equal and 120 degrees out of phase. The factor for such a system is therefore 1.732 times the factor for a single conductor.

In a three-phase, 4-wire system, balanced load, the factor for drop between phase wire is the same as for a 3-phase, 3-wire system, balanced load. Factor for the drop to neutral is the same as for a single conductor in any system. D.c. may be calculated in exactly the same manner as single phase a.c. using 100 percent power factor.

With this article is presented an original nomographic chart for accu-

rate calculation of voltage drop in a three-phase system, based on the formula: $e = \frac{I \times F \times L}{1000}$.

Use of the chart can best be explained by example. Assume that the allowable voltage drop, the length of the run, line current and power factor are respectively: 3 volts, 200 ft., 140 amp., and 100 percent. Place a drafting triangle as shown on the chart so that its upper edge (not hypotenuse) intersects 3 volts and 200 ft. Slide the triangle so that the right hand edge intersects 140 amp. A vertical line from the intersection on the right



VECTOR DIAGRAM for single-phase circuit in which power factor is varied while load current and potential remain constant shows that maximum voltage drop occurs when line and load power factors are equal (see fifth vector from horizontal)

hand edge (not hypotenuse) with the "base line" crosses the 100 percent line. The proper wire size for a single conductor cable in iron conduit is just to the right of this last intersection, in this case No. 4/0. If the power factor were 90 or 95 percent, the size would be 300 MCM; if 70, 75, 80 or 85 percent, 350 MCM.

Similarly if the wire size, power factor, length of run and line current are respectively No. 2, 70 percent, 50 ft. and 900 amp., a vertical line is extended to the "base line" from the intersection of No. 2 line and 70 percent line. The triangle is placed so the right hand edge intersects the voltage drop line at 1.25 volts, the voltage drop for these conditions.

Cautions in Application

For most effective use of the chart, the triangle should be placed so that it intersects the reference lines as nearly at right angles as possible. "Length of run" and "line current" scales are interchangeable. Practice will indicate how best to manipulate the triangle.

On the chart the voltage drop to neutral is indicated. In reality this is the voltage drop in a single-conductor in any system, single- or three-phase. Without any modification in its use, if this drop in a single conductor is read, the drop in a single-phase, two-wire (or three-wire balanced) system is merely twice the indicated drop to neutral. Thus the chart can be used to solve either single-phase, two-phase or three-phase voltage drop problems. Also it can be used with but little error for three conductor cable problems. Charts of similar construction also are available for different types of industrial installation such as open wiring.

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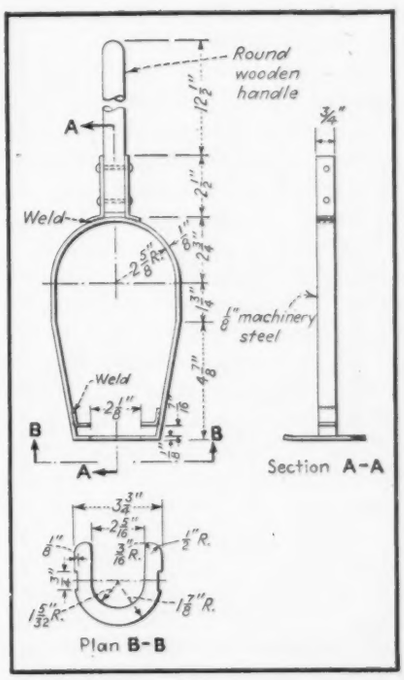
Socket Picker for Ornamental Lamps

To facilitate changing series street lamps of the ornamental type, the socket picker device illustrated herewith has been developed by Herbert C. Hanson, maintenance electrician of the Worcester (Mass.) County Electric Co., and will shortly be offered as a standard available in the distribution practice of the New England

CUT-AWAY photograph of lamp remover demonstration by Thos. Joyce

Power System. The need arose from the difficulties encountered in such work, especially in connection with inverted globes, and where a bulb may be broken. The previous method of standing on top of a ladder and reaching full arm length into a deep globe with rubber gloves trying to free a tight socket is a trying and sometimes hazardous job.

The picker is a short-handled device for pulling "frozen" or tight sockets out of the receptacle, and has no hand clamps or springs to get out of order. It consists of a U-shaped piece of $\frac{3}{4}$-in. by $\frac{1}{8}$-in. steel mounted on a short wooden insulating stick. The open end of the "U" is fitted with a single piece, horseshoe-shaped socket grip and a holding flange. The flange is placed $\frac{7}{16}$ in. above the grip and is designed to keep the socket from jumping out of the picker as the socket terminals are released from the receptacle. The horseshoe shaped grip is $\frac{1}{8}$ in. thick with an inside curve radius of $1\frac{5}{32}$ in., this radius being chosen after experimentation to provide for varying socket sizes. The pull on the socket is against the socket collar. In use, the picker is inserted in the globe at an angle with the U-shaped piece over the lamp. When the top of the "U" touches the lamp top it is swung into a vertical position and lifted. The grip then engages the collar in the socket. If the lamp has been broken the insertion is similar, without engaging the lamp. Under tension, the picker can be rocked or shaken to free the socket.



DETAIL of lamp remover device for use on 10,000-15,000 lumen, 20-amp. lamps in upright ornamental standards

An All-Industry Approach To Commercial Lighting

Milwaukee utility mobilizes electrical industry groups for unified attack on store re-lighting and wiring market—Plan envisions utility function as coordinator and clearing house for information—Symposium on commercial lighting presents suggested designs for basic store types

CHARLES N. LAUPP, Wisconsin Electric Power Co., Milwaukee, Wis.*

"Get there fustest with the mostest. . . ,"—Nathan Forrest's famous battle plan—conveys the essence of Wisconsin Electric Power Co.'s program for an all-industry attack on the commercial lighting market in Milwaukee. Broad objectives of the plan, launched in October, call for:

1. Reaching the prospect first, while plans are on the drafting board.
2. Bringing manpower of the entire lighting industry to bear on the market.
3. Presentation of a unified lighting story by all industry groups based on the best, latest and most complete engineering information.

This plan reflects the company's realization that its commercial lighting staff alone can not hope to develop the vast commercial lighting market effectively on a personal call basis; that the logical utility function is one of unification and guidance. Utility responsibility lies in acting as a clearing house for information on lighting developments, application and design, and in coordinating the efforts of groups within the industry to the end that a sound, unified and cohesive version of the engineered-lighting story reaches every commercial lighting prospect.

All-Industry Meetings

Under this program an all-industry symposium on commercial lighting was launched October 1, under joint sponsorship of the IES and the Wisconsin Electric Power Co., that exemplifies the company's plan for cooperative development of the commercial lighting market.

The symposium encompasses 10 bimonthly meetings dealing with the special lighting and wiring needs of particular types of retail stores. In these sessions actual lighting designs for hypothetical stores of different types are presented. Illustration material accompanying this article shows the kind developed for the symposium.

The meetings are tailored to the needs of the audience of electrical contractors, union electricians, jobbers' salesmen, fixture manufacturers' representatives and architectural draftsmen and other lighting industry groups for whom the course was intended.

Common Objectives

All meetings in the series have five common objectives. Each objective bears on the company's over-all plan for developing an all-industry approach to the store lighting market. Conduct of the meetings, size and make-up of the audience, selection of the symposium faculty, and methods of presenting and preserving discussion material in a permanent portfolio were all coordinated to attain these five common objectives:

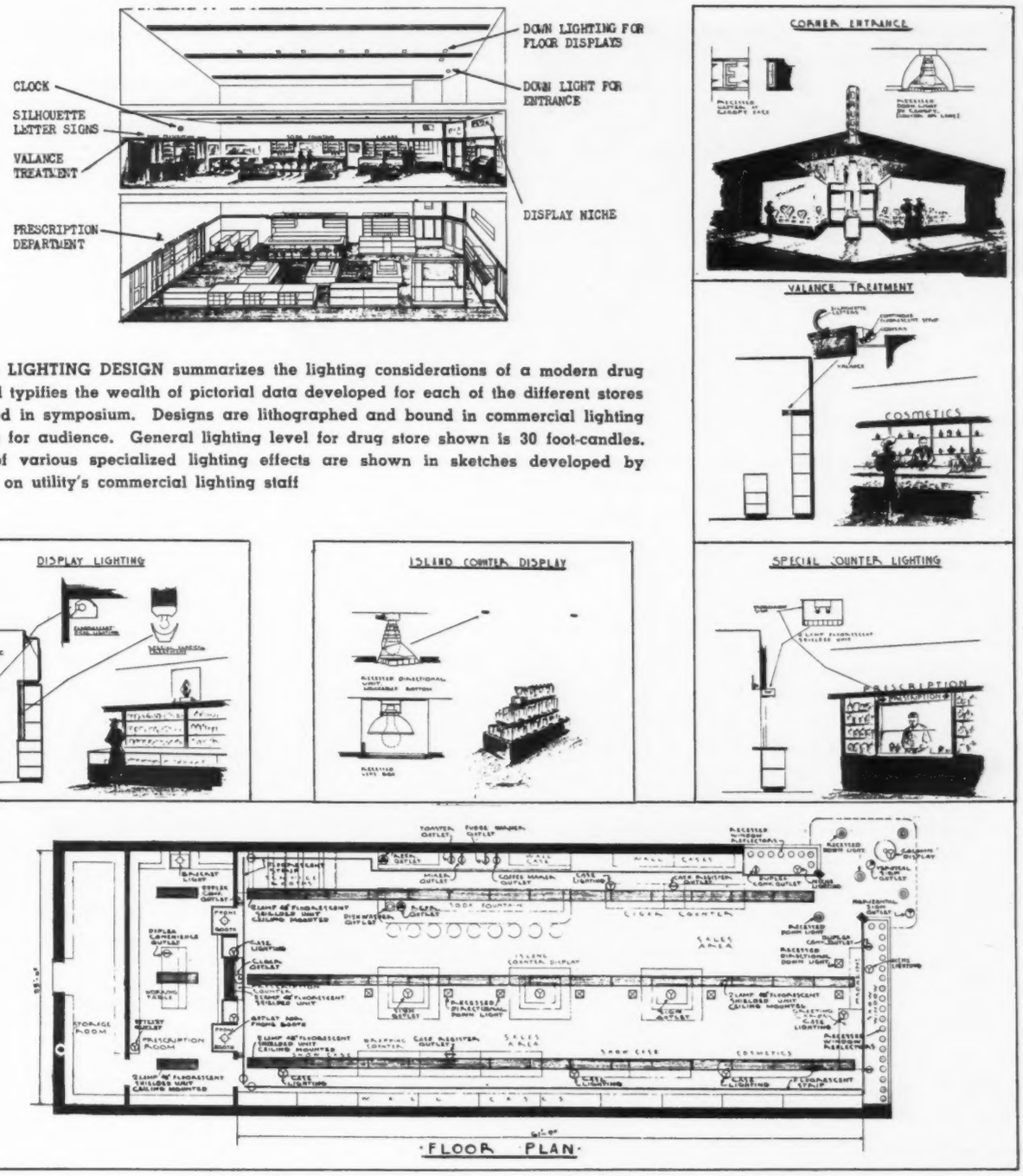
1. *Demonstrate Market Potential.* For each class of store present, statistics are presented showing the amount of potential lighting and wiring business that exists. Object is to awaken appreciation of the magnitude of the market and instill enthusiasm.

2. *Show Need for Salesmanship.* These are not sales meetings but attention is given to overcoming mistaken attitudes of customers toward lighting and wiring, its costs and benefits. For example, a $5,000 investment for relighting a food store can be presented to the customer in proper perspective when compared with the investment in other major store fixtures, such as refrigerated show cases.

3. *Establish Common Design Objectives.* Throughout the meetings principles of lighting design and economies

FACULTY GROUP—Typical of other faculty panels is this trio of specialists on drug store lighting and wiring: (left to right) Jennings Murphy, executive secretary, Wisconsin Pharmaceutical Assn.; E. H. Schaefer, lighting engineer, Wisconsin Electric Power Co., and Orville Nichols, president of A. C. Electric Co., electrical contracting firm. The model store was developed by Mr. Murphy to demonstrate drugstore layout

* Commercial Lighting Supervisor.



TYPICAL LIGHTING DESIGN summarizes the lighting considerations of a modern drug store and typifies the wealth of pictorial data developed for each of the different stores considered in symposium. Designs are lithographed and bound in commercial lighting portfolios for audience. General lighting level for drug store shown is 30 foot-candles. Details of various specialized lighting effects are shown in sketches developed by architect on utility's commercial lighting staff

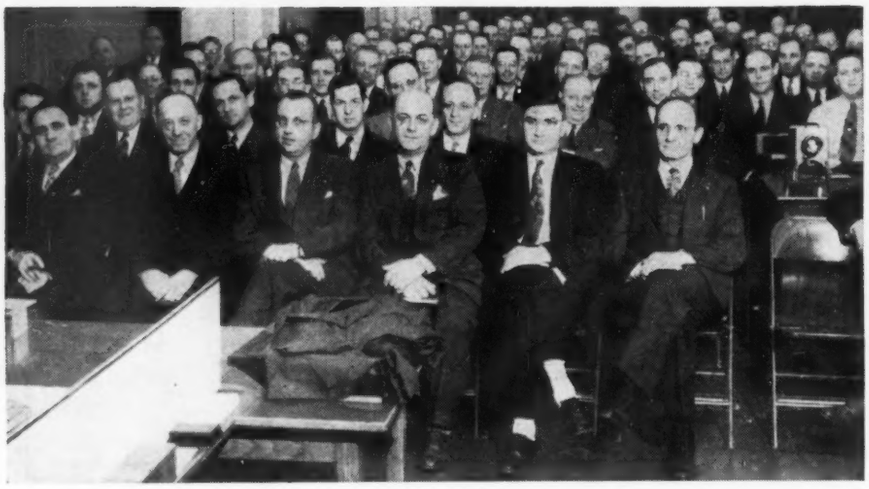
of adequate wiring common to all classes of commercial installations are emphasized so that all industry groups —jobbers, contractors, union electricians, fixture manufacturers, and draftsmen—will absorb—and in turn present—a uniform, consistent story of lighting quality to the customer. Association of adequate wiring principles with the commercial as well as residential field is fostered. Wiring for the ultimate need instead of immediate load is stressed as a principle.

4. *Interpret Modern Design Techniques.* By demonstration and illustration in architects' drawings, the applications of various types of lighting techniques to different merchandising problems are shown. New lighting tools and developments are interpreted and their applications outlined. Tendencies to think of store lighting in terms of general illumination—20 to 25 percent of potential load—are overcome.

5. *Explain Utility Clearing House Function.* The company's function as a clearing house for information on commercial lighting and wiring is explained. Services of the commercial lighting division are offered for consultation and assistance in the layout of store lighting; availability of the company library of technical and application data is emphasized.

In all of the above objectives every attempt is made to fit the industry members to act as competent lighting advisers should they be called in by architects or store owners.

Principal portion of each meeting session is devoted to the presentation of a detailed and complete lighting design for a particular type of store complete with an architectural rendering of the inside of the store, in perspective; a detailed floor plan for the store showing arrangement of fixtures



SYMPOSIUM ON COMMERCIAL LIGHTING—Representing the men who do 75 percent of all lighting installations and 100 percent of the major lighting jobs in Milwaukee, this group forms the industry task force that will relight Milwaukee stores

Electrical Plan for Modern Drug Store

LIGHTING EQUIPMENT	Circuits	Wattage
Canopy and Entrance		
Sign	1	1.200
Recessed	1	0.800
Vertical Sign	1	1.200
Column Display Case	1	0.500
Window Lighting	8	4.000
General Lighting		
44-100 watt fluorescent units	6	4.400
Prescription Department, Phone Booth, Display Cases at rear, Bracket at sink, Clock, rear Convenience Outlets, Storage room	2	1.500
Down Lighting		
9-200 watt recessed units	2	2.000
Valance Lighting, Niches and Show Cases	3	3.000
Convenience Outlets	2	1.500
	22	20.100 kw.

REFRIGERATION SERVICE		
Fountain Refrigerator, ¼ hp	0.250	
Back Bar Refrigerator, ¼ hp	0.250	
Coffee Maker	1.800	
Fudge Warmer	1.000	
Toaster	2.000	
Mixers	1.000	
Prescription Dept. Refrigerator and Hot Plate	1.800	8.100
		28.200 kw.

ADDITIONAL SERVICES	SERVICE REQUIREMENTS
Time Switch for window and signs.	200-ampere service switch
Heating Plant and Air Conditioning.	150-ampere fusing
Basement Lighting.	24-circuit lighting cabinet

and lighting equipment; and architects' sketches showing how lighting can be used for special merchandising tasks, such as attraction lighting, entrance and window lighting, island counter lighting and valance treatments.

Reproduction of the architectural drawings developed for each type store are planographed and bound in an individual commercial lighting portfolio for each member attending the lecture course. Typical drawings for drug store lighting are illustrated.

Faculty members who address the meetings were carefully selected from among local I.E.S. members. Of 20 speakers only five—one in four—were utility people. These two decisions are based on the company's desire to build the prestige of local lighting specialists.

Three types of speakers were used to discuss each type of store or commercial establishment:

1. A speaker from the local retail association (of druggists, grocers, etc.), discussed the special problems of merchandising in that field and related these problems to the need for special lighting.

2. A manufacturer's or jobber's representative or utility lighting engineer was generally called upon to discuss applications and lighting design.

3. An electrical contractor discussed the wiring problems involved in each class of commercial establishment.

A studied effort was made to restrict registration for the lighting series to between 100 and 125 and to confine attendance to *working* members of the lighting industry who are sincerely interested in the subject. Precautions were taken to avoid attracting volatile "course takers" whose enthusiasm runs high for a few sessions and then drops to nothing.

To control attendance a registration fee of $3.00 was charged, $1.50 to be refunded for 80 percent meeting attendance. The balance will be used for refreshments at the last meeting.

Notices of the meetings were taken to the Milwaukee Chapter of the Electrical Contractors Assn. and to the electricians' union. Jobbers were contacted personally and others of the lighting industry were reached by mailing notices from the I.E.S. membership list.

Registrations by the third meeting had reached 125. Those in attendance were the men in the lighting industry who do 75 percent of all lighting and wiring installations in Milwaukee and 100 percent of the major jobs.

PROGRAM of Meetings for Commercial Lighting Symposium

1. The Lighting Market—Store Functions
2. Hot and Cold Cathode, Slimline, Incandescent Lamps; Lighting Design for Modern Food Store
3. Lighting for the Drug Store—Planned Church Lighting
4. Lighting the Jewelry Store—Women's Apparel Store
5. Lighting Design for the Restaurant—Men's Furnishing Store
6. Lighting Layout for Shoe—Hardware Stores
7. Lighting the Furniture Store; Appliance Show Room Planned Church Lighting
8. Comfort Considerations for Seeing; Offices—Schools
9. Decorative Lighting Applications Night Clubs, Public Areas, Luminous Fronts
10. Color and Lighting — Lighting Equipment Exhibit

Europe Leading U.S. in Farm Service a Myth

Valid comparisons between rural electrification in U. S. and in European countries are impossible, but available data show our nation far ahead

E. A. STEWART, Interstate Power Co., Dubuque, Iowa

AWAY BEHIND certain European countries, particularly Sweden, Denmark and Holland. That's a pretty general impression of the status of rural electrification in the United States. This impression results from the spoken and written statements of many men and agencies that some years back helped to condition the public mind for establishment of the Rural Electrification Administration and that now are offered in justification of ever larger appropriations for expanding REA operations. REA does not need that kind of propaganda.

They say that in this country only 40 percent of the farms now have electric service, while in Europe before the war, 95 percent of the farms in France had service, 85 percent in Denmark, 100 percent in Holland, 65 percent in Sweden, 55 percent in Norway, and 83 percent in Belgium.

Comparisons Not Valid

Such comparisons certainly make it appear that we are lagging woefully behind in bringing electricity to our farms. But they are not valid comparisons. They neglect, either by intention or ignorance, several determining considerations.

One consideration is size. The land area of continental United States is 3 million square miles; France, the largest country named above, is not even one tenth as big and Belgium, the smallest, is less than one percent of our size. If rural electrification in all of Europe were set beside that of our country the comparison would be more nearly reasonable—which is impossible because the figures are not available—and the writer is willing to make a modest wager that the United States would show much the higher ratio of the two.

Let us select some areas in this country that are more nearly equal in size to the cited European nations and see how the comparisons shape up. Massachusetts, Connecticut and Rhode Island have a total area of 13,926 square miles and over 83 percent of the farms in these states are electrified. The comparisons with 85 percent in Denmark (16,570 square miles), with 83 percent in Belgium (11,752 square miles), even with the 100 percent in Holland (13,208 square miles), are not unfavorable to this country.

Sweden has 173,157 square miles and 65 percent of its farms have electric service. Compare this country with California which has 155,652 square miles and 83 percent of its farms electrified. Or take the Pacific Coast states of Washington, Oregon and California, of whose farms over 75 percent are connected to electric lines and whose area of 318,095 square miles is larger than any European country except Russia.

Putting the comparisons on more nearly equal basis relative to sizes of areas does not by any means remove all the error from them. There still remain the differences between a farm in Europe and one in the United States. In some European countries there are no, or very few, farms as we know farms here. The decriers of rural electrification progress in this country say that 95 percent of the farms in France have electric service. That is an impressive ratio. But it loses all validity as a comparative quantity when one considers what and how big French farms are. They average 24 acres. They are simply crop and pasturage fields. The peasants who work them do not generally live on them, but in "communes" or small villages. Thus a group of "farms" is served by connecting up the houses in the village where the farmers live.

The same condition of farms much smaller than those in the United States and of farmers living in villages prevails in greater or less degree all over Europe. How can that be compared with the condition in this country where the average farm has over 175 acres and farmers live on them? It takes about 35 miles of line to serve 100 American farms. The same number of European "farms" can be connected by bringing service to two or three villages.

And the whole story of unfair comparison is not told yet. Segregated data on rural electrification, according to reports to the 1936 World Power Conference, are not generally available for European countries. The ratios quoted as of farm electrification are in some cases not that at all. For instance, the 83 percent for Belgium and the 100 percent for Holland are actually the ratios for all customers in the two nations, it being assumed by these American propagandists that the same proportions obtain in farm service. The Conference report from Holland says, "It is reasonable to assume that an appreciable percentage of the farms are without electric service."

Comparison of Usage

Information presented at the Conference indicates that the use of electricity on European farms is low. Of Belgium it was said the "rural communes often show minimum values of consumption of 15 kw.-hr. per inhabitant per year." Indicated average energy usages for eight cooperatives in France varied from 44 to 263 kw.-hr. per subscriber per year. In pre-war Germany the annual average per farm was only about 300 kw.-hr. Set these figures alongside the approximately contemporary averages for the period 1932-1935 of about 800 kw.-hr. per farm per year in the eastern part of the United States and nearly 7,000 kw.-hr. in the Mountain and Pacific regions.

Thus it appears that valid comparisons of rural electrification progress between the United States and European countries are impossible and that honest attempts to set up such comparisons must result in the conclusion that our country is not behind those nations, but is far ahead of them in electric service to farms.

Criteria for Post-War Substation Design

Successful war-time expedients provide basis for continued evolution toward simpler layouts—Cost in two decades potentially reduced nearly two-thirds—Factory-assembled gear permits omission or lowered cost of building—Removable air breakers an aid

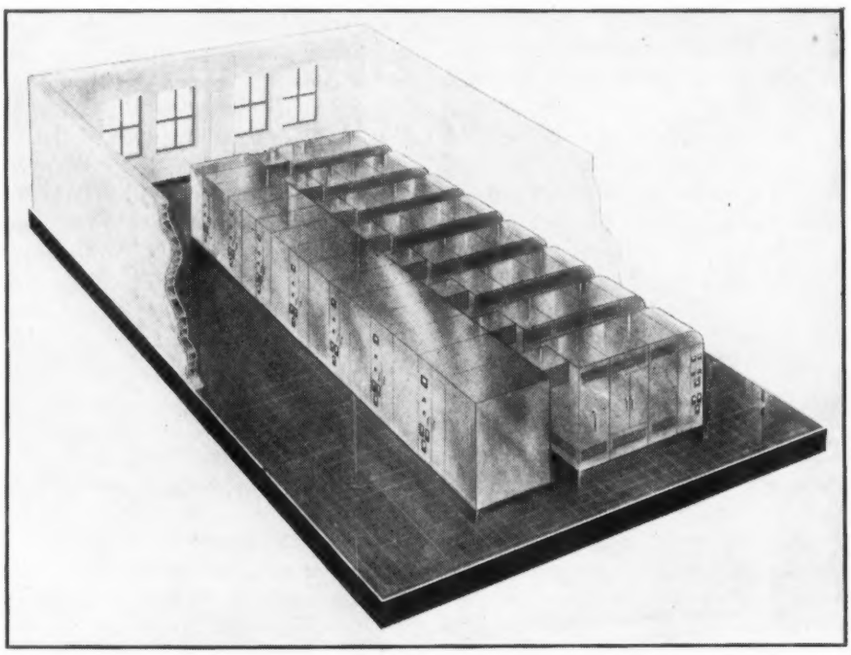
J. S. PARSONS and R. L. WITZKE*, Westinghouse Electric Corp., East Pittsburgh, Pa.*

MANY fundamental design practices adopted during the war, as a matter of expediency to conserve critical materials, have sufficient merit to warrant post-war adoption. The permanent value of these practices has been verified by the service continuity maintained during the emergency with an absolute minimum of equipment and manpower. Some of the gains that can be made by the adoption of these new fundamental design practices can be illustrated by reviewing a number of typical substations.

A typical substation in common use about two decades ago is Substation A, (Fig. 1). The single 13.8-kv. bus is automatically sectionalized; the main and auxiliary 4,160-volt buses are automatically sectionalized; the 4,160-volt transfer bus is manually sectionalized. Three single-pole breakers and three single-phase induction regulators are used to control each feeder circuit. The 15-kv., three-pole breakers, as well as the 4160-volt breakers, are of the cell-mounted, fixed-position type. Three percent reactors are installed in each feeder circuit to limit the short-circuit stresses on the regulators, which are designed for a maximum short-circuit current of 25 times rated current. The four three-phase transformers are oil-insulated, with automatic air blast to provide emergency capacity. This station will provide excellent service but at a high cost compared to other available designs.

Cost of the electrical equipment for this station, designed for a firm capacity of 16,000 kva., is $21.75 per kva. In addition, the installation and building costs will be high because of the space requirements and the large number of component parts required. Some of the features that account for this high cost are the single-pole 4,160-volt circuit breakers and the single-phase regulators, refinements that many companies have found unnecessary for general application. The use of both 4,160-volt auxiliary and transfer buses and the many disconnecting switches, to minimize service outage times and to maintain equipment, is also expensive.

Introduction of metal-clad switchgear with removable three-pole, air circuit breakers and triplex regulators makes considerable savings in investment possible. The flexibility and reliability of Substation A can be retained and savings realized by the adoption of these improvements, as has been done in Substation B, (Fig. 2). The cost of the electrical equipment has been reduced to $13.60 per kva. or 63 percent of Station A. The installed cost will, however, be relatively high when building and wiring costs are considered.



CUTAWAY view of large indoor distribution substation "C" showing its completely metal-clad equipment. Its feeder-unit construction provides maximum flexibility for load changes. All connections between unit assemblies are short, insulated metal-clad buses. Air circuit breakers and transformers are used throughout to eliminate the hazards of oil fires. Removable air breakers with spares are included

* Distribution Engineer and Central Station Engineer, respectively.

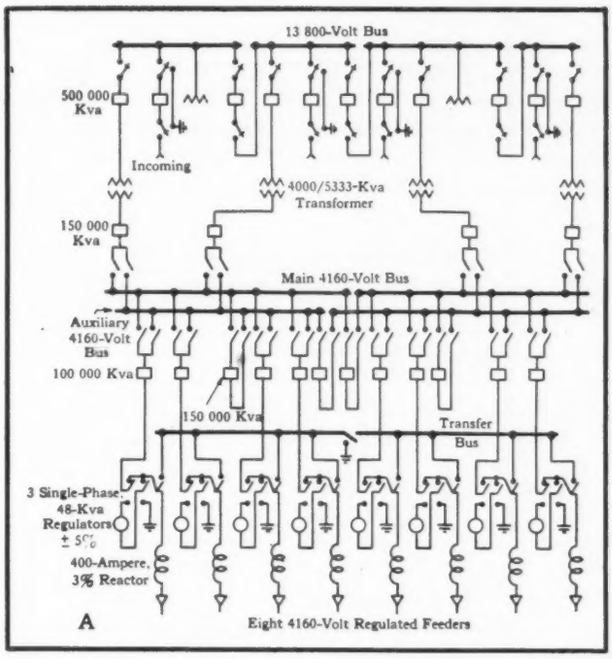


FIG. 1—Substation "A", an individual-feeder-regulated substation as commonly built 20 years ago; electrical equipment cost, $21.75 per kva.

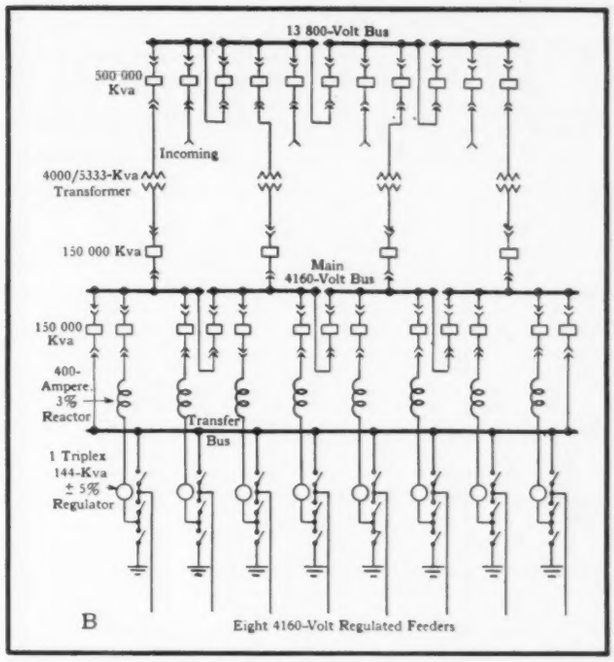


FIG. 2—Substation "B", a modification of substation "A" to take advantage of modern equipment; electrical equipment cost, $13.60 per kva.

Prevailing Design Practices

Modern equipment results in the greatest cost reduction when used in conjunction with modern, simplified substation designs. Substation C, Fig. 3, illustrates this point. The use of metal-clad switchgear with removable air breakers throughout has eliminated the need for the large number of disconnect switches used in Substation A. By providing one spare 15-kv. and one spare 4-kv. breaker, any breaker can be maintained by withdrawing it and inserting the spare in its place. The proved reliability of modern equipment has justified the substitution of a magnetizing current break switch for the 13.8-kv. transformer breakers. The station is designed on a unit basis with one TCUL, three-phase, dry-type transformer associated with each feeder. The transformers are not paralleled on the 4,160-volt side so the feeder breakers have an interrupting capacity of only 50,000 kva. No transfer bus is included, on the basis that facilities will be available outside the station for switching load from one feeder to adjacent feeders. These switching facilities should be provided in any event to restore service quickly in case of feeder trouble, so can be used to maintain substation equipment. The failure of a transformer will result in an outage on two feeders, but this will not materially affect service continuity with modern transformers because most service interruptions will be due to feeder trouble.

Cost of the electrical equipment in Substation C is $11.60 per kva. or only 54 percent of the equipment cost in Substation A. The installation cost will also be considerably lower because of the factory-assembled equipment used. The use of air transformers and breakers permits safe installation of all equipment indoors without providing for the hazards of oil fires. The relative floor spaces required for Stations A and C is evident from the floor plans in Fig. 4.

Transfer Bus

Cost of adding a transfer bus to Substation C, (Fig. 5), is $2.00 per kva. The transfer bus is energized from an extra transformer provided with a selector switch for connection to either of two high-voltage bus sections. Each feeder circuit has two breaker compartments, one connected to a transformer secondary and the other to the transfer bus. Removable breakers are normally installed only in the transformer compartments, and one spare breaker is provided for transferring a feeder to the transfer bus for either transformer or breaker maintenance. The cost of Substation D is $13.60 per kva. or 63 percent of the cost of Substation A.

The above discussion has been devoted to indoor stations only, although the same general comments apply to outdoor stations. The cost of the electrical equipment in Substations C and D will be 5 or 6 percent lower in an outdoor station. The outdoor metal-clad switchgear will be higher in cost, but this is more than offset by the lower cost of the oil-insulated transformers used outdoors.

Bus Regulation

Experience of some power companies has indicated that 5,000 or 6,000 kva. of load can be bus regulated with little or no supplementary individual feeder regulation. Where bus regulation can be employed, further savings in substation investment are possible. Three basic arrangements of bus-regulated substations are illustrated in Figs. 6, 7, and 8. These stations have a firm capacity of 16,000 kva., the same as Substations A, B, C, and D. Each station is designed to control a maximum normal load of 6,000 kva. through one set of regulating equipment. The voltage of each group of three feeders is regulated independently so the feeders can be grouped according to length or required regulation.

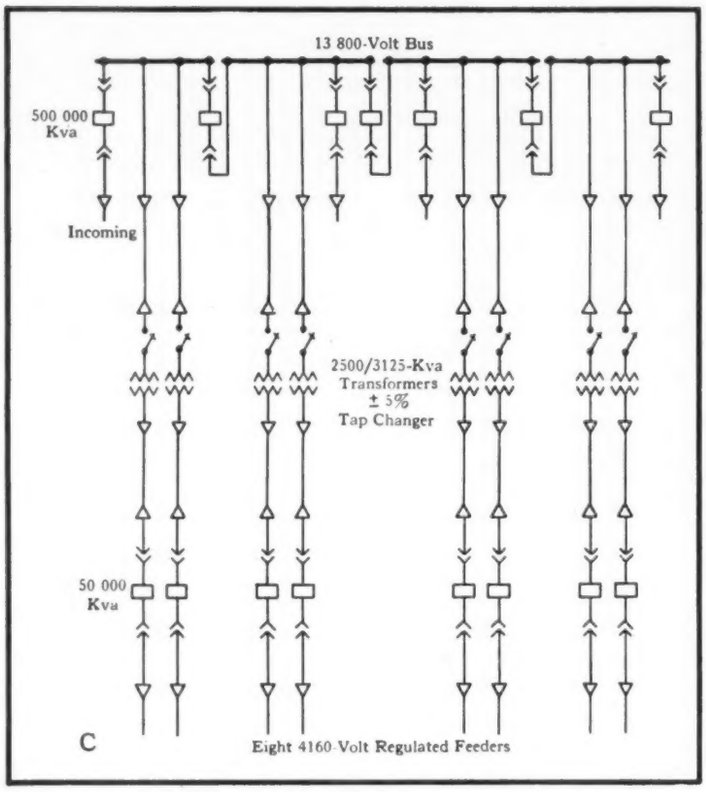


FIG. 3—Substation "C", an individual-feeder-regulated substation of simplified unit design; electrical equipment cost, $11.60 per kva.

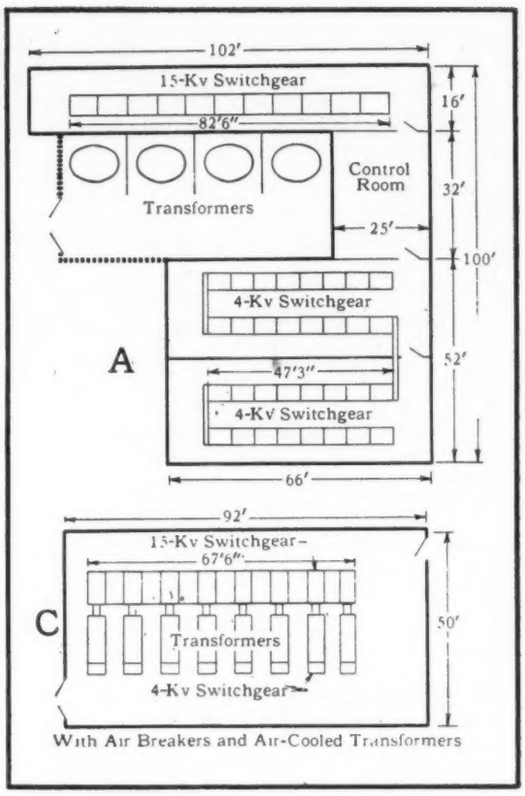


FIG. 4—Floor plans of buildings for substations "A" and "C" indicate relative floor spaces required

The stations are so designed that a supply circuit fault will cause no, or only a momentary, service interruption. All stations will carry a load of 16,000 kva. with any one supply circuit out of service.

One Unit, Three Feeders

The 13.8-kv. switching in Substation F, (Fig. 6), is basically the same as for Substation C. One three-phase transformer with TCUL supplies three feeder circuits, and no two transformers are normally paralleled on the 4,160-volt side, in order to limit the fault current and to allow independent regulation of the three feeder buses. A transfer bus is included in this case because it would be impractical to transfer the load from three feeders at the same time outside the station to maintain station equipment. A spare transformer is included to carry the load of three feeders in case of transformer maintenance or failure. Each feeder circuit has two breaker compartments, one connected to a transformer bus and the other to the transfer bus.

Removable breakers are normally installed only in the transformer bus compartments; feeders are transferred to the transfer bus by using one spare feeder breaker. The cost of the electrical equipment in this station is $9.20 per kva. or only 79.3 percent of the cost in Substation C, the lowest cost station with individual feeder regulation. This cost is based on oil-insulated transformers and indoor metal-clad switchgear with air breakers.

H. V. Breakers Omitted

In Substation G (Fig. 7), two transformers connected to separate supply circuits are bussed on one 4160-volt feeder bus. Any one supply circuit or transformer can be removed from service and the remaining transformer can supply the entire group load without a service interruption. The cost of the electrical equipment in this station is $9.65 per kva., which is slightly higher than the equipment cost in Substation F. However, the absence of high-voltage circuit breakers will give this station a cost advantage when the supply-circuit voltage is above 15 kv.

Tie Closed Automatically

The transformers in Substation H, (Fig. 8), are not bussed on either side so this station will not render quite as good service as Substations F and G. When a transformer breaker is tripped manually or automatically, the bus tie breaker is closed between the feeder bus and the transfer bus. If the transformer breaker has been tripped automatically, restoration of normal voltage on the transformer secondary will trip the bus tie breaker and then close the transformer breaker. Normal conditions are restored by manually tripping the bus tie breaker if the transformer breaker has been manually tripped. As no two transformers are ever paralleled, there is a momentary service interruption during the transfer of load between buses. When using indoor metal-clad switchgear with air breakers, and oil-insulated transformers, the cost of the electrical equipment is $8.20 per kva.

Outdoor Cost Higher

Cost of the electrical equipment for Substation F, G, and H will be some 6 to 9 percent higher when installed outdoors because of the higher cost of outdoor metal-clad switchgear. However, the installed substation cost may be lower because no building is required.

Summary of Principles

The basic principles which were followed in the design of the above substations can be summarized in the following manner:

1. Use of standard metal-clad switchgear with removable air circuit breakers throughout, allowing simplification of the station, eliminating unnecessary disconnect switches, and minimizing maintenance time.

2. Omission of transfer buses used solely for maintaining breakers and other apparatus associated with a single feeder.

3. Installation of spare transformer capacity to pick up load automatically in case of a supply circuit failure, and manually in case of a transformer failure.

4. Holding feeder fault kva. to 150,000 or less by limiting the maximum transformer capacity connected to a feeder or feeder bus.

5. Simplification, or if conditions warrant, omission of high-voltage switchgear.

6. Use of bus regulation wherever possible.

Russian Gas for Power

Seven regions in the Ukraine will be crossed by a 500-kw. pipe line to feed natural gas from the Carpathians to the city of Kiev. Before the war Kiev had to rely on petroleum and coal from distant points. Now the local power plants will be converted from coal to gas and avert the hauling of coal over a transportation system already heavily taxed. Other establishments to have gas are heat plants, factories, bakeries, laundries, hotels, apartments, etc.

Reserves are estimated to be 55 billion cubic meters, enough to supply Kiev with 1,500,000 cubic meters a day for some 25 years.

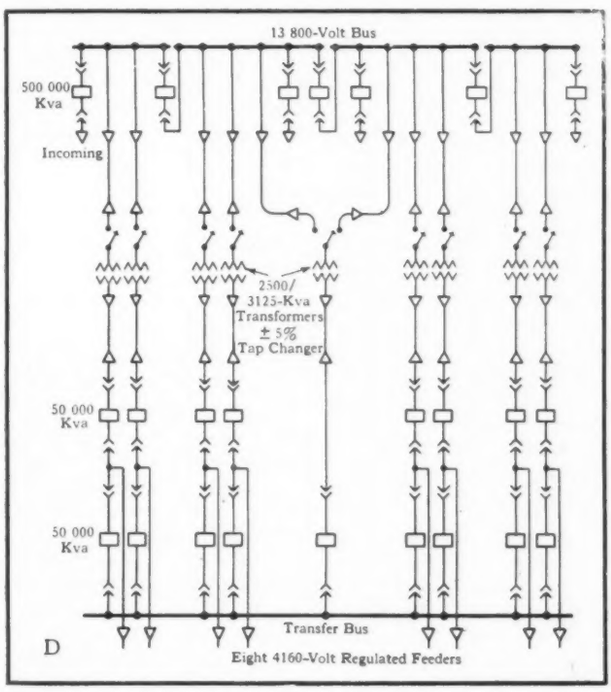


FIG. 5—Substation "D", a substation similar to substation "C" except provided with a transfer bus for ease of maintenance; electrical equipment cost, $13.60 per kva.

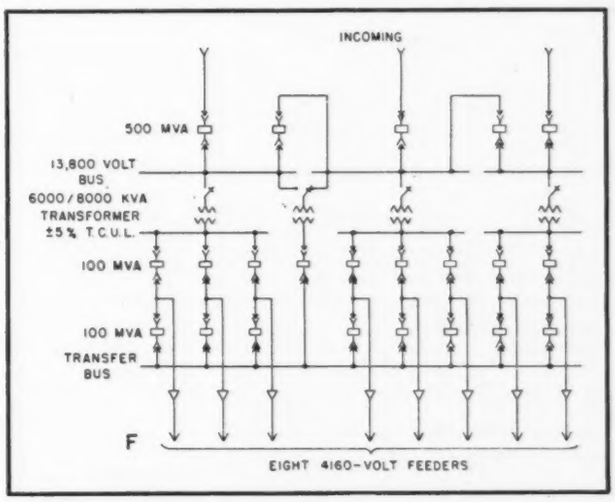


FIG. 6—Substation "F", a bus-regulated substation with its transformers bussed on the high-voltage side only; electrical equipment cost, $9.20 per kva.

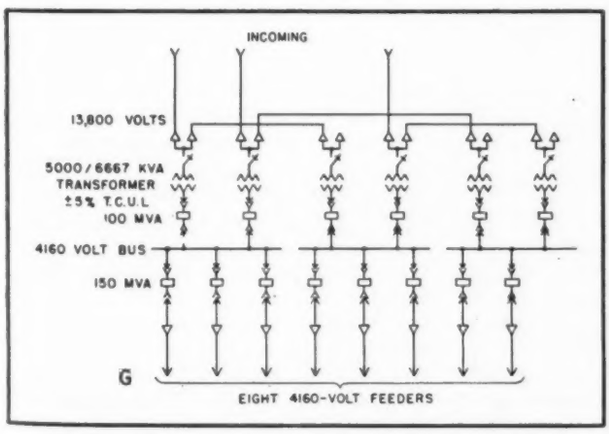


FIG. 7—Substation "G", a bus-regulated substation with its transformers bussed in pairs on their low-voltage side only; electrical equipment cost, $9.65 per kva.

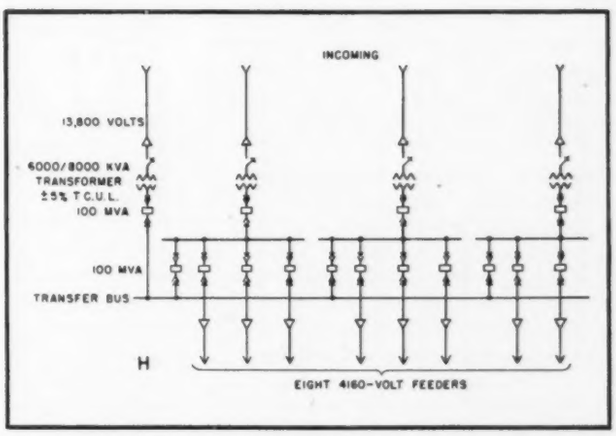


FIG. 8—Substation "H", a bus-regulated substation in which the transformers are not bussed on either side in the station; electrical equipment cost, $8.20 per kva.

DIGESTS

Condensations and abstracts of articles in the foreign press, committee reports, unpublished papers before numerous technical societies, research bulletins, standards.

Versatility Features Mobile Substations

From a paper by S. B. Farnham, Central Station Engineering Divisions, General Electric Co., presented before the Southeastern Electric Exchange, Raleigh, N. C., October 4, 1945.

MOBILE SUBSTATIONS have become recognized as essential, not only for emergencies, but also as temporary replacements, relieving seasonal overloads or carrying temporary loads, today are used in half the 48 states, besides helping rebuild war devastated areas overseas.

Two fundamental factors have an important bearing on their design and use: (1) A tendency because of their versatility to include the maximum kva. capacity and range of voltages, and (2) limitations on weight, dimensions, etc., because they must travel over public highways. Consequently there was until recently almost complete lack of uniformity.

Typical mobile unit substations incorporate incoming line switching, fuse protection and transforming capacity, and switching, metering and protection for the outgoing feeder circuit, all mounted on suitable highway trailers. Sizes available for standard 3-phase circuits range from 750 kva. to 3,750 kva. Incoming circuit voltage ratings go up to 66 kv. Outgoing circuits fall into two classes, 2,400 volts and 4,160 volts, or 2,400, 4,160, 7,200 and 12,470 volts.

Forced-oil, forced-air type are used in the larger transformer ratings. Smaller units are cooled with forced air only, the oil circulating by convection.

Automatic winding temperature protection is incorporated in all units, starting the fans, lighting a warning signal lamp, or ringing a bell, and finally tripping the breaker if the temperature continues to rise.

Where the substation weight exceeds 35,000 lb. a double rear axle is necessary to conform to loadings permissible in most states and to prevent overloading. Overloading of tires up to 20 percent is generally considered acceptable, as the yearly mileage is very low and age becomes the principal cause of tire deterioration. Screw jacks remove the load from the tires when the unit is in use and permit leveling.

As regards movement, no two states have identical restrictions. Different features may be the limitations in adjoining states. Whenever the desired rating should exceed the restrictions in one or more of the states involved special permits may be obtainable. Requests for these generally receive utmost consideration, since mobile units are primarily emergency equipment designed for public service, and since highway restrictions are designed to govern common carriers that travel over the road continually, whereas the substations move infrequently and are handled by a highly competent, responsible organization.

Effects of Weather on Power Systems

From a discussion by J. S. Forrest before a joint meeting of the Institution of Electrical Engineers (British) and the Royal Meteorological Society, October 18, 1945.

WEATHER FORECASTS can assist power system operators in preparing loading and maintenance programs and in taking precautions against damage due to abnormal weather. Forecasts of thunderstorms, sudden falls in temperature, and particularly sleet, are the most important. Fortunately an accurate 12-hr. or even 6-hr. forecast would be much more satisfactory than a longer one of doubtful accuracy. It is essential that the short-period forecasts be transmitted by radio or other rapid means to all interested personnel.

Heating and lighting components of the total electric power load are determined almost entirely by weather. The heating load is serious as it is a large proportion of the total. It varies with the air temperature and to a less extent with wind velocity and relative humidity. Sudden cold spells may introduce irregular and often unforeseeable load increases.

As an example, a comparison was made of the total generated load for southeast England for two consecutive Mondays, January 29 and February 5, 1945. The only significant difference was that the mean temperature January 29 was 25.5 deg. F. and February 5 was 50.5 deg. The mean load for January 29 was 1,500 mw. and for February 5 was 1,180 mw. Thus a drop of 25 deg. in the mean temperature caused an increase of 31 percent in the mean load. At the same time the peak load was up 22 percent.

Laying Cables by Plow

From an article by P. F. Clark in "Electrical Review," London, September 14, 1945.

EXPERIENCE over the past two years by the Northwest Power Co. (England) with a device for laying 33-kv. cable in an underground trench, prompted the improvement of the method and construction of a new cable-laying plow which has three separate elements. The leading one is a caterpillar-type tractor on which is mounted the reel of cable to obviate the tedious job of laying out the cable in front and then pulling it back through the colter of the plow as the latter moves along.

Coupled directly behind by a kingpin is the plow chassis, which carries the cutting blade. By using interchangeable blades cables of various sizes up to a diameter of 4 in. can be laid to a depth of 3 ft. A hand winch which raises and lowers the plow blade can also be used for lowering an empty cable reel or moving the rear portion of the plow into place for connection to the front portion after the two have been separated, as for changing reels.

The third section is a grout car which is towed by the plow. Pre-mixed concrete is carried in a tank on the grout car, which is mounted on a caterpillar-type tractor. The feed of grout to the trench to surround the cable as it is laid is through a pipe supplied by tangential buckets on a wheel rotating inside the

tank. The drive of this wheel is by a friction disk in contact with the tractor belt, so that the amount of concrete varies directly with the speed of the plow, ensuring a nearly constant section of concrete around the cable. This plan was adopted as it was felt that the cable should be given protection against movement of the soil around the cable. It also fills the bottom of the slot cut by the plow and restricts movement of the cable itself. There is a further advantage that the heat transmission is uniform along the cable, and hot spots are prevented.

Best speed for plowing has been found to be 12 yd. per min. A very steady pull has been obtained and the cable can be handled with great care. Six men can operate the device.

Standardization of A.C. Turbo-Generators Proposed

From a paper by G. A. Juhlin in the "Journal of the Institution of Electrical Engineers" (British), September, 1945.

VARIATION IN requirements imposed by the operators of large electrical machines, particularly turbo-alternators, affect all manufacturers, and unification of requirements is the first step toward standardization. Complete interchangeability of all machines of a given rating would be ideal, but even mechanical interchangeability of units would be of considerable benefit. The main requirements for the latter are:

1. Uniform overall dimensions, including height of center and foundation seatings.
2. The same dimensions of rotor journals and shafts within the pedestals.
3. Duplicate couplings.
4. The same position for outgoing terminal leads, and arrangements for interchangeable connections.
5. Identical positions for slip rings.
6. Similar ventilating systems, with air-trunk connections suitable for coupling to machine inlets and outlets.
7. Suitability of direct-connected exciters for the same foundations and for coupling to the main shaft.
8. Interchangeability of house sets.

Voltage of 33 kv. could be recommended for machines of 30,000 kw. or larger, as they have proved reliable in service, and show some advantage in efficiency and space owing to the absence of transformers. It would be necessary to retain 11 kv. for machines where the system voltage is 66 kw. or higher, as it would be uneconomical to wind machines for 33 kv. and then step up the voltage.

Apart from the cost it may be undesirable to specify any greater voltage range than necessary. Operation at voltages below normal may result in instability with leading power factor, since the stability decreases as the field ampere-turns are reduced. Determination of the power factor of a machine for a particular system needs more consideration than formerly owing to the charging currents of high-voltage systems. It is not economical to build machines for 0.8 lagging power factor when 0.95 is required, and may be undesirable on account of stability, as leading power factor usually is the rule at night on systems with high lagging power factor during the day. A machine built for 0.8 lagging power factor would not be as stable at power factors between 0.9 lag and 0.95 lead as one of the same dimensions built for 0.9 lagging power factor.

The short-circuit ratio, saturation and leakage reactance also must be taken into account; in general a high short-circuit ratio indicates a high margin of stability. Machines subjected to leading power factor should have a higher short-circuit ratio than those used with lagging power factor only.

High-reactance machines are demanded in order to limit the short-circuit kva. to be handled by the switchgear, but high reactance usually requires deeper stator slots, which in turn increases the stator diameter. Reactances recommended as standard for a 30,000-kw., 37,500-kva. rating at 3,000 r.p.m. are 11 percent for an 11-kv. machine and 18 percent for a 33-kv. machine; for a 50,000-kw., 62,500-kva. rating at 1,500 r.p.m. the reactances are 15 percent for an 11-kv. machine and 20 percent for a 33-kv. machine.

Electric Truck Kiln for Potteries

From an article by H. E. Meuche in "Brown Boveri Review," October, 1944.

FOR POTTERIES intermediate in size between those using small chamber kilns and those with continuous tunnel kilns an electric truck kiln is advantageous. The kiln proper is rectangular, and a cooling oven of equal size is alongside. A track runs into each, and the two tracks are connected by a transfer table outside. Ceramic products are stacked on a truck, which is run into the kiln. The capacity is about 3 cu.yd.

Heating is by alloy elements mounted on porcelain tubes placed in walls, roof and door of the kiln and in the truck. Temperature is controlled by thermostats in the kiln, used in connection with a program controller.

Ordinarily the charge is inserted at 6 p.m. and heated at a rate to reach 950 deg. C. at about 4 a.m., the temperature then being maintained constant until 6 o'clock, when current is cut off and the kiln allowed to cool all day, reaching about 350 deg. At 6 p.m. the truck is run out and transferred to the cooling oven and a new charge on a duplicate truck is inserted. The earlier charge is transferred to the cooling oven, and remains until the next day, when it has cooled to between 30 and 40 deg.

On this cycle the truck kiln takes about 800 kw.-hr. per charge and has a weekly capacity of 21 cu.yd. Carborundum and corundum grinding wheels are fired at 1,100 deg. C., taking 2,500 kw.-hr. for a gross charge of two tons, the heating requiring 32 hr. and cooling 100 hr. Similar kilns are suitable for firing electrical porcelain such as large insulators. Since the maximum temperature is 1,300 to 1,400 deg. carborundum heating elements are used.

Time-Deflection Characteristics of Moving-Coil Instruments

From a paper by G. F. Tagg in the "Journal of the Institution of Electrical Engineers" (British), September, 1945.

DESIGN OF moving-coil instruments includes consideration of such factors as damping and speed of response in addition to torque, resistance, and the like. For instruments such as ammeters and voltmeters the time-deflection characteristics determine the time of response but have no effect on the steady reading. In such instruments as the ballistic galvanometer and the fluxmeter they are of importance, as they determine the reading.

Response time, or time to come to rest, is important for any instrument. This can be defined as the time from the moment of switching on until the pointer reaches its final reading within the stated accuracy of the instrument, and after that remains within the accuracy.

To check the accuracy of a design which has taken into account speed of response and damping, it is necessary to obtain by test the variation of deflection with time. This involves the use of a combined timing and viewing mechanism such that the position of the pointer can be observed at any time after the instrument has been switched on. Two devices are described, one incorporating a resistance-capacitance circuit for timing and a discharge lamp for viewing; the other a mechanical arrangement in which the timing is obtained by the aid of a syn-

chronous motor and the viewing is through a shutter tripped by the motor at the desired time. The latter device is useful when the instrument pointer goes to rest in 1 sec. or less.

Effects of alternating and impulsive torques on a moving coil instrument are of interest. Sometimes it is desired that an alternating torque should have maximum effect, while in other instances its effect should be as little as possible. In a rectifier-operated instrument, for instance, the current consists of a d.c. component to be measured along with superimposed harmonics. The latter should cause negligible vibration of the pointer. In a vibration galvanometer, on the contrary, a tuning device is provided so that the movement will give maximum response to current of a desired frequency.

High-Frequency Hardening of Plastics

From an article by Dr. H. Stäger and Dr. F. Held in "Brown Boveri Review," September, 1944.

SINCE THE MORE common plastics have relatively high power factors and corresponding dielectric constants it is possible to heat them internally with high-frequency current, which produces the highest temperatures within the piece rather than the surface. The phenol resins, such as bakelite, seem particularly suitable for the method, and were selected for a series of tests made by Brown, Boveri & Co. A self-excited 1.5-kw. high-frequency electronic generator producing about 23 megacycles was used. During the tests internal temperatures were obtained by embedded thermocouples, and test sections cut from the hardened specimens were used to determine the amount of hardening and the final chemical composition.

It was found that the power factor is highly dependent on the temperature. As the hardening progresses both of these drop on account of the reduction in conductivity, thus giving a considerable measure of automatic control over the process. Tests showed that the hardening of phenol resins from the interior outward by high-frequency current can be done much quicker than with ovens or hot-plate presses. A comparison of the two methods is given in the table.

Comparison of Preparation of Plywood Boards by Heated Molds and High-Frequency Current

	Thickness of Board, cm.		
	1.27	*2.6*	*15.4*
High-frequency electric heating:			
Power required, watts	6,670	17,900	37,500
Reaction time, min.	1.1	2	8.2
Energy required, watt-min.	7,350	35,800	307,500
Hot-plate method:			
Reaction time, min.	2,375	8.32	342
Energy required, watt-min.	8,520	40,700	409,000
Ratios:			
Hot-plate time to high-frequency time	2.15	4.16	41.7
Hot-plate energy to high-frequency energy	1.16	1.138	1.33

Micro-Breaks for Tumbler Switches

From a paper by F. C. Fuke in the "Journal of the Institution of Electrical Engineers" (British), September, 1944.

USE OF MICRO-BREAKS in tumbler switches permits a complete change from time-honored practices and should reduce manufacturing costs materially. Apart from the electrical advantages considerable mechanical advantage would accrue, as the inertia of moving parts would be greatly reduced and there would be less wear and tear.

Tests show that the rate of recovery of dielectric strength of short air gaps is of the order of 25×10^6 volts per sec., so that only a short separation of contacts is required to prevent an a.c. arc from restriking. The breakdown voltage for a space of 0.005 in. is above 850. For a 230-volt supply this gives a factor of safety of 3.7 at 25 deg. C., and even at 100 deg. C. the factor of safety is 2.8 for 230 volts.

With a break of 0.005 in. the arc voltage drop is about 15, while with a switch of long quick-break type it may rise to that of the circuit itself. Speed of break should be such that on a 50-cycle system contact separation is made in 0.005 sec., which is one-fourth cycle.

German Synthetic Wire Insulation

From a report of the Rubber Bureau, War Production Board and Office of Rubber Reserve, RFC, Washington, D. C., August, 1945.

EXTENSIVE INFORMATION on German synthetic rubbers, including technical data on compounding, construction and processing of rubber-insulated cable and wire, was obtained by a group of Allied technicians sent into the occupied territory by the War Production Board and the Rubber Director.

For low-voltage flexible cables Buna S and polyvinyl chloride plastics were most commonly used. Cables for more than 1,000 volts were generally lead covered. During the last two years restrictions were eased to permit underground installations of cable with a coating of steel, aluminum or zinc crimped on and protected with asphalt-saturated paper and cotton braid.

Most insulation was put on by the strip process. Smaller wires were usually insulated in multiples of 24, two layers of compound being calendered to 15 mils.

For high-voltage cable one company stripped two layers and extruded the additional insulation, taping it separately. This cable was used for 3,000 volts and was claimed good for 6,000 volts. Another company stripped and taped the complete insulation at once. A third company extruded without prior strip covering. Extrusion speeds were slow, about 100 ft. per min. for a ½-in. cable.

System Load Forecasting

From an article by G. O. McLean in "Electrical Review," London, July 27, 1945.

PROBABLE LOADS in individual areas, or even in the area fed by one substation or one feeder, can be predicted by using the laws of probability. Hamilton in *Electrical Engineering* for June, 1942, showed that load forecasting is really synthesizing known individual loads, weighted to allow for various factors, such as rated load of individual appliances connected, type of tariff, social habits and weather. All of these factors lend themselves to scientific treatment, although the mathematics cannot be rigorous. The principal factors are the installed load (about 80 percent) and weather (about 10 to 15 percent).

As an example, if 900 cookers of similar characteristics have been added to a supply area in the eight months between two winter peaks, what effect will they have on the system peak? Each cooker can cause a small peak of say 4 kw.; but there is a lack of coincidence between peaks. Knowing the individual cooker load characteristic a summation over an extended period can be made. If the number of loads, N, is increased to infinity, the summation will equal the integral of the curve depicting the single load.

The cooker demand being known, the consumer's load factor tells the energy consumed in the day. If he uses more energy it means that he is using the appliance for longer periods, with more likelihood that the time of his demand will deviate from normal. This can be expressed mathematically or determined empirically.

Finally, the factor which takes care of the number of peaks in the concentration period, N, can be defined as the ratio of the resultant peak to N times the peak of one cooker. This and the non-uniform distribution in time will increase the aver-

age load by an amount proportional to the square root of the actual number, N, assuming an infinite number of such loads.

What Causes German Line Failures

From a Summary Report on Investigation of Electric Power Practice in Germany, prepared by Herbert J. Scholtz, Commonwealth & Southern Corp., Birmingham, Ala., and Charles F. Wagner, Westinghouse Electric Corp., Pittsburgh, Pa., for the War Utilities Subcommittee of T.I.I.C., October, 1945.

ELECTRICAL LINE failures for the high-tension systems of the RWE were furnished for the eight-year period from 1931 to 1938, as a part of the investigation of power practice in Germany conducted by the authors under the auspices of the War Production Board. Most of the engineers interviewed on the subject were more concerned with fog and dirt than with lightning, although the statistics do not justify this attitude, as will be seen from the tabulation.

Summary of Electrical Line Failures 110-kv. and 220-kv. Systems of the RWE Eight-year Period, 1931-1938

	110 Kv.		220 Kv.	
	Number	Percent	Number	Percent
Failures, classified:				
Single-phase (line to ground)				
Caused by lightning (known by mag. links)	264	31	174	40
Caused by fog and dirt (known by mag. links)	64	7	95	22
Other causes	280	32	95	22
Total single-phase failures	608	70	364	84
Polyphase (cleared by circuit breakers)				
Caused by lightning	216	25	28	6
Caused by fog and dirt	18	2	31	7
Other causes	26	3	11	3
Total polyphase failures	260	30	70	16
Total system failures	868	100	434	100
Failures due to lightning	480	56	202	46
Failures due to fog and dirt	82	9	126	29
Ratio, single-phase to polyphase				
Due to lightning	....	1.24	....	6.66
Due to fog and dirt	....	3.50	....	3.14
Total failures	....	2.33	....	5.25
Ratio, lightning to fog and dirt				
Single-phase, line-to-ground failures	....	4.43	....	1.82
Polyphase failures	....	12.50	....	0.86
Total failures	....	6.22	....	1.59
Average length of lines for 8-yr. period, miles	....	1,610	....	1,010
Length of lines as of September, 1939, miles	....	1,960	....	1,440
Failures on a basis of 100 mi. per yr.				
System total	6.75	100	5.33	100
Single-phase, line to ground	4.67	70	4.51	84
Polyphase	2.08	30	0.84	16
Total for summer half-years Apr. 1–Oct. 1	5.33	80	4.13	7
Total for winter half-years Oct. 1–Apr. 1	1.42	20	1.22	23
Ratio of fog and dirt failures in winter to those in summer	....	0.55	....	0.62

Television-Sound System Developed by British Firm

From a release by the British Information Services, November, 1945.

COST OF TELEVISION may be reduced considerably, both for the broadcasting station and for the public, by a new system announced by the firm of Pye, Ltd., which pioneered in radar and was prominent in its development during the war. The new system embodies the principle of "pulses," lasting a few millionths of a second, such as are used in radar. With it a home set can receive both vision and sound. Previously a transmitting station needed two distinct units, one for the picture and one for sound. Likewise the receiving had to be done on two sets, either separate or housed in one cabinet.

When a television transmitter is sending, short intervals occur when no signal is emitted as the tracing spot returns to its starting point to begin a new line. These intervals, each ten-millionths of a second, represent one-tenth of the total time, and there are 10,125 of them a second. These periods are used in the new system to send "sound snapshots."

It is claimed that the new system eliminates the possibility of interference in the television receiver between sound and vision; it permits a far simpler receiving aerial; less frequency space is needed, as both sound and vision are transmitted on one frequency; pictures are held steady, even during severe signal fading; clear reception for television sound programs is possible at greater distances because of less noise and interference.

Surface Hardening Of Steel by High-Frequency Current

From an article by R. Casti in "Brown Boveri Review" for September, 1944.

EDDY CURRENTS produced by strong high-frequency fields cause intense local heating even in good conductors, a phenomenon which is being used to advantage in the hardening of thin peripheral layers of steel by very rapid heating, the heated portion then being hardened by rapid cooling. Since only the surface is heated a minimum amount of energy is required and the heating time is extremely short. The inner core of the metal is not affected, so the warping is much less than with other methods, and usually the machining can be completed beforehand while the metal is soft, as compared with the subsequent grinding which is necessary with most other surface hardening methods.

If enough power is used to permit the hardening temperature to be reached very quickly the heat dissipation is small, and if the part is cooled immediately it is possible to harden to depths of less than 1 mm. (0.04 in.). The three principal factors involved are the depth of penetration of the eddy currents, the power per unit surface area, and the heating time. The depth of penetration, or thickness of the current-conducting peripheral layer, is proportional to the reciprocal of the square root of the frequency, while the power input is directly proportional to the square root of the frequency.

For carbon steel heated to 850 deg. C. in about 1 sec. with 500-kc. power the depth of penetration is about 0.9 mm. (0.036 in.). The faster the heating the less heat is produced, and consequently the thinner the layer hardened.

In order to permit the transfer of the necessary energy the coupling between the inductor and the charge should be as close as possible, and the inductor should be adapted to the contour of the part treated. The inductor may be of tubular copper, water cooled. For large specimens where the available power is too small to heat the entire surface at once, or where the contour is irregular, progressive hardening may be used. Long shafts can be hardened with low power by advancing them at a suitable rate or rotating them during the process. Gear teeth may be hardened successively.

A test on a disk of 15 percent chromium steel 250 mm. (10 in.) in diameter and 10 mm. (0.4 in.) thick was made by heating the periphery to its hardening temperature (950 deg. C.) and quenching in cold water. The heating period was 3 sec. with a power input of roughly 50 kw. at about 250 kc. The hardened layer was 1.5 mm. (0.06 in.) thick as determined metallographically. The maximum measured hardness in Vickers units was 585 kg. per sq.mm., corresponding to a Brinell hardness of 536 kg. per sq.mm.

In another test four annular zones of the surface of a 30-mm. (1¼-in.) shaft of 0.5 percent carbon steel were treated. The input was roughly 10 kw. and the frequency about 415 kc. The initial hardness was 325 in Vickers units. The following table shows the result in the four zones hardened:

	Zone on Shaft			
	1	2	3	4
Heating time, sec.	0.5	0.75	1.0	1.5
Hardness, Vickers units	782	752	803	782
Thickness of hardened layer, mm.	0.5	0.86	1.05	1.45

The tests indicate that increasing the heating period affects only the thickness of the hardened layer, but not to any extent the maximum hardness. Variation of the heating time, therefore, can be used as a means of determining the depth of the hardening.

Editorials

S. B. WILLIAMS, *Editor*

New Limits for A. C. Transmission Voltages

COMING ON THE EVE of what may be the largest power expansion program ever undertaken in this country, the announcement in last week's issue of a major research project to investigate phenomena and equipment associated with a. c. transmission up to voltages as high as 500 kv. is of great economic as well as technical interest.

The surprising thing is that such an investigation wasn't initiated a long time ago. It has been apparent for some time that while large sums of money were being expended on research on d. c. transmission, the technical and the economic feasibility of which had never been determined, the technology of a. c. transmission was advancing, and transmission voltages up to 287,000 volts had been successfully mastered. And even at that voltage the margin between complete knowledge and total ignorance was fairly narrow.

The failure to broaden that margin is all the more surprising when it is considered that it has been apparent for some time that sooner or later the present level of a. c. voltage transmission would prove to be inadequate and that both in this country as well as in a number of foreign countries, voltages higher than any that had been reached heretofore would be called upon.

Examining the foundations underlying the structure of our present highest voltage a. c. transmission practice, it has been evident to those who looked closely that knowledge about many of the fundamentals needed for a sound foundation has been extremely meager, and in many cases entirely lacking. Thus, no full scale corona measurements above present operating voltages had even been made, nor had such measurements been conducted over a period of time sufficiently long and sufficiently diverse as to climatic conditions to give a full integrated effect to such time and climatic factors. Of necessity conductor design and ideas of conductor spacing based on such limited data cannot have the precision that a satisfactory economic solution demands. Again, the very essential knowledge necessary to determine insulation level at these high voltages has been lacking since ideas as to the dominating factor in determining basic insulation level are based upon theoretical and particularly experimental knowledge gathered under conditions and with switching equipment that have long been proved obsolete. If, for example, our present ideas of the magnitude of switching surges are not borne out by data gathered on a system using more modern switching equipment operating in three cycles or less, it is evident that a considerable reduction in insulation strength may be obtainable without sacrificing either safety or continuity.

Furthermore, as voltages of transmission have been pushed up, equipment designs based upon past performance at lower voltages heretofore have been developed and put into operation without the benefit of previous experience under test with full scale equipment at the higher voltage. This has of necessity tended to over-design.

All the above will be the theme of the investigation being undertaken by the American Gas & Electric Service Corp. in cooperation with a group of nine manufacturers as announced. The completion of that investigation should make available a body of information that will make possible the design of transmission lines in the range of 275-500 kv. with the same precision and with no more unnecessary factor of safety than now prevails on voltages much lower down the scale. The fact that plans are now being made to have the equipment, involving power transformers, lightning arresters, towers, conductors, and special measuring instruments, installed in operation in early or mid 1946, and later to put into service switching equipment, current transformer and potential devices, indicates that the electric utility industry and the manufacturers supplying it have a high degree of confidence in the requirements they will be called upon to meet in the not too distant future. It adds, too, another distinction to an organization that because of its unwillingness to accept closed frontiers to technical practice has contributed greatly to the advancement of the economics of electric power supply.

Range Wiring Doesn't Have to Be Expensive

WIRING COSTS have always been one of the bugaboos of electric range promotion and now with prospects of the greatest range activity ever experienced they have returned to haunt the sales forces. At a recent sales meeting it was reported that quoted range wiring prices were far above pre-war figures, so far in fact that they might be too great a hurdle to take.

If range wiring actually were to cost upwards of $75 to $100, there is no question but what range installations would be slowed down very greatly. However, they do not need to cost so much or anything like it. In the first place, any quotations made today on a hypothetical job sometime in the future are bound to contain a substantial margin for contingencies. Until we are assured a plentiful supply of labor and materials, lump sum bidders will have to protect themselves. Since it may take a year or more for supply conditions to become reasonably stabilized, it

might be well to work out a temporary program for handling range wiring on the cost-plus-fixed-fee basis.

At the beginning this will probably be high because of lost skills or new men or even new contractors. Progressively, however, costs should come down due to improved efficiency and the gradual elimination of the high cost installers.

Looking forward to the time when there is more stability and the contractors can share in improved efficiencies, it would be advisable for the contractors, dealers and utilities to work out a simple plan that would put range wiring on a production-line basis. In fact, if this were done intelligently, it might surprise the people in some areas to find that post-war range wiring costs, in spite of higher wages, were below those before the war.

In some instances, restrictive wiring ordinances may have to be studied for alternative methods that are safe but less costly to install. While everyone concerned should insist upon a safe installation, it may be found in many instances that a greatly simplified procedure will produce equally safe, if not safer, work.

Here again joint studies with the trade and inspection department should produce good results, especially if everyone understands that the income results to wireman, dealer, as well as utility, can easily be less for the more costly job.

Some cities had worked out a very satisfactory low-cost range wiring program before the war, but the great variation in costs the country over indicated that much more could have been done. With a record-breaking program like a million ranges a year facing the industry, it is time now for all concerned to start working cooperatively to find a price policy that will insure the public of safety, the wireman of work, the contractor of greater income and the utility of more load.

Interference with Television

PEOPLE IN THE POWER INDUSTRY can still recall the grief that the advent of radio caused. It has all pretty well settled down now to serenity but there were days when every click, every squawk and buzz was attributed to "leaky insulators," "noisy transformers" and all kinds of innocent causes. Many a power company had to detail a man or two to run down the often unwarranted kicks. Much of their time went toward placating the customer and it was often a simple matter of tracing the poor performance of the radio set either to its own internal idiosyncrasies or to loose sockets and fuses, dirty commutators on refrigerator motors, defective switches and the like in the home. Meanwhile, the power companies did fix up the pole-line hardware, the insulator ties, tree contacts, etc.

Now that television is just around the corner, is the power industry going to experience the same thing all over again just because the eye is quicker than the ear in sensing distortions and defects? That depends, of course, on whether the television frequency band and the scanning cycle are more or are less susceptible to extraneous disturbances. How do the harmonics and field strengths stack up as to potentiality for excitation and potentiality for response?

Undoubtedly, there are television and 60-cycle engineers who know the answers to this question but they have been quite silent. Maybe there is nothing to be worried about. However, the load cultivation departments of the utilities might be considerably more willing to back the radio dealers in pushing a television market if their own engineers could reassure them on that point.

SEC Idea of Maximum Holding Company System

EVER SINCE the Holding Company Act was passed ten years ago, the question of how large a system could be retained by any company remained unanswered until the decision of the Securities and Exchange Commission last week permitting American Gas & Electric Co. to keep its central system. These integrated properties which comprise some 85 percent of the total investment of the parent company were held by SEC to approach the maximum size consistent with the standards of localized management, efficient operation and effectiveness of regulation required by the Act.

Some idea of the extent of what SEC considers the maximum permissible operation may be gathered from a few statistics of the AGE central system. It operates in nearly 2,000 communities in seven states, serving over three million population and an area of approximately 90,000 square miles tied together with 2,000 miles of high-voltage transmission lines ranging from 110,000 to 154,000 volts. The system roughly extends from the shores of Lake Michigan to Virginia-North Carolina line. In 1944 the system load was over 9 billion kilowatt-hours with a maximum one-hour simultaneous demand of nearly 1.5 million kilowatts.

It is doubtful if SEC ever contemplated the retention of such an extensive system operating in so many states, but voluminous studies indicated that here was a system that had been engineered as such and was operated so efficiently that no separation could have any economic justification. Nor was there any question as to effective regulation because neither FPC nor any state commission raised any objection.

Reading between the lines of the decision one senses that the Commission has done the unusual thing of paying a fine tribute to careful planning, economical operation and good management. These apparently are much more important to the Commission than mere area in determining how much may be retained, for where nothing is to be gained by separation the Commission takes the common sense path. By this decision SEC virtually acknowledges that it is much easier to partition financially integrated systems regardless of their complexity than systems which have been engineeringly integrated to operate economically.

WASHINGTON COMMENT

By R. N. LARKIN, Washington Correspondent

Congress Needs an Impartial Power Expert

THERE has been considerable discussion of the need for a thorough revamping of Congress. Suggested remedies run from pay increases to elimination of the snuff boxes in the Senate chamber. Undiscussed as yet, however, is the practical idea that Congress hire an impartial power expert and advisor.

In recent years, Congress has appropriated hundreds of millions for electric power facilities. Regardless of ideology, such amounts warrant extreme care in appropriation. Congress now has no expert advice on the technicalities of electric power marketing except that obtainable from the Federal Power Commission and the Interior Department. These sources are no more disinterested than are private company experts.

Power Strange to Lawmakers

Hearings before House and Senate appropriations and other committees dealing with federal power projects show how non-existent is the average lawmaker's conception of that with which he deals when he considers a power question. No congressman need be able to discourse on power factor determination but the man who doesn't know base load from peak load or the difference between a kilowatt and a kilowatt-hour is ill-prepared to rationalize on U. S. power policy. One congressman, for instance, who has been voting pro-public power for some years, expressed surprise recently on learning that a hydroelectric plant in a multi-purpose dam might be justified solely on the basis of its value as a peaking plant.

Two other examples of why Congress might use an impartial power expert are in Part I of the Senate hearings on the first deficiency appropriation bill, recently enacted. Attempting to obtain funds for the proposed Reclamation Bureau transmission grid in California's Central Valley, Sen. Carl Hayden, Arizona Democrat, attacked as inequitable an exchange contract between Reclamation and Pacific Gas & Electric, whereby Reclamation, owning no transmission lines which could do the job, gives P.G.&E. 1.75 kw.-hr. at Shasta substation and receives 1 kw.-hr. at its Contra Costa pumping plant in the San Francisco Bay area. Line loss is 11.6 percent. The remainder represents transmission cost. Hayden assailed the contract, saying:

It Must Be So

"All I know is that it (the transmission cost) is excessive. I am sure it is excessive, and that the House committee must have concluded that it was."

There is small reason to believe that Sen. Hayden, a county official, soldier and congressman since 1904, could qualify as an expert witness on whether the contract is or is not in the public interest. He needs and should have the expert advice the California Railroad Commission would seek before passing on such a question. Then Sen. Kenneth McKellar, Tennessee Democrat, assailed the conclusion of a witness, Edward Falck, former head of the Office of War Utilities, that power capacity being appropriated for in the then-pending deficiency bill would not be necessary for some years.

"My judgment is that you are entirely mistaken about the amount (of electric power) that is going to be needed in this country," McKellar asserted. "There is hardly any limit to the electric power that can be used in this country . . . so I disagree with you entirely on all your line of reasoning."

McKellar is that well known electric power expert who attempted to delete from an appropriation bill the funds required to build transmission lines through which the power available at Fontana and Kentucky dams could be poured into the TVA system.

Where might Congress find such a power advisor, concededly, is easier to suggest than to accomplish. The man who would be acceptable to one side of the public-private ownership fight would doubtless be anathema to the other. He would have to be at once a master engineer, economist, financial expert and ideologically sexless —truly a difficult man to find.

But the first deficiency bill—which is strictly tide-over legislation, designed to keep things going until regular appropriation bills take effect July 1—provides for expenditure of about $26,000,000 on power features of Reclamation projects alone. Ultimate cost of this power is $357,000,000. These figures do not include Army engineer projects whose initial power capacity is 1,000,000 kw. So the question changes. No longer is it sufficient to ask, Can such a man be found? It becomes much more in point to ask, Can Congress afford not to find and employ such a man?

Congress Needs Self-protection

The McKellar and Hayden incidents are amusing but trivial. What is important is whether Congress shall have all the facts and an expert, impartial opinion as to their meaning. Then it will be better equipped, for instance, to pass on the wisdom of installing three new 108,000-kw. generators in Grand Coulee Dam when there already exists a surplus of 570,000 kw. in the region.

Whence will come capable advice on the disparity between Grover Neff's presentation of the status of rural line building and that of the Rural Electrification Administration? Neff says present REA funds are sufficient. REA says 21 states are out of funds and are crying for more. Who's right? Congress must determine, but it is in poor shape to do so.

Allowing for the exigencies of politics, Congress has been told repeatedly that there is a power shortage in the Northwest, where no war or peace load has gone unserved. The Central Valley debate has been rife with allusions to monopoly and single outlets for Shasta power despite P.G.&E.'s offer to buy and sell at rates set by the Federal Power Commission and the California Railroad Commission.

Congress needs impartial expert advice for self-protection.

NEWS OF THE WEEK

Industry Awaiting Results of 6 Supreme Court Suits

Constitutionality of "Death Sentence Clause" of Holding Company Act not Decided Though Case Has Been Argued—TVA Suit over Right to Acquire Land Will Be Heard in 1946—Other Cases May Be Heard

The Supreme Court closed 1945 with six cases of interest to the electric power industry on its books, two of them awaiting decision, one awaiting argument, and three awaiting a ruling on whether they will be heard.

Heading the list is the long-delayed determination of the Constitutionality of the "death sentence clause"—sections 11 (b) (1) and 11 (b) (2)—of the Public Utility Holding Company Act of 1935. Case was argued in mid-November, but the court adjourned for the year without handing down its decision.

Another case awaiting settlement is that of New York vs. U. S. wherein the state seeks to have its bottled water business declared beyond the reach of the federal taxing power. It was argued recently, with public power groups intervening to support the state's position.

A case as yet unargued, but which the Supreme Court has agreed to hear, and three more on which certiorari has been sought but not yet granted or denied, contain considerable interest.

That which the court has agreed to review is a consolidation of six cases wherein the Tennessee Valley Authority attempted unsuccessfully to acquire land in western North Carolina which was cut off when the filling of Fontana Reservoir flooded out the only road giving access to a remote section. TVA argued that the lower court which ruled out the acquisitions in question erred in "holding that the court can review a determination made in good faith by the board of directors of the TVA as to the necessity for acquisition of an interest in land, and substitute judgment for that of the board of directors."

The case came up on certiorari from the Fourth Circuit Court of Appeals. It arose through the filing in the U. S. District Court for the western district of North Carolina of six condemnation petitions and six declarations of taking, applying to plots of land in a remote, 44,000-acre tract adjoining the Great Smoky Mountains National Park. All 216 family residences therein were cut off when Fontana Reservoir flooded a state highway which gave the only access to the tract and when the War Production Board indicated it would withhold priorities for materials with which to construct another road, estimated to cost $1,400,000. Land damages would have totaled another $750,000, and TVA considered the combined damages too great.

After lengthy wrangles between the state which wanted all land in the tract removed from private ownership if no replacement road were to be built, and the county which required $400,000 indemnification for a bond issue it had floated to build the road, TVA agreed to take all the land and arranged to turn it over to the National Park Service for an addition to Great Smokies Park.

Six owners, declaring the agreement was a dodge to obtain the land for the National Park Service, moved in District Court for dismissal of the condemnation actions and were upheld on the ground that no part of the land at issue was necessary for TVA purposes. The Circuit Court upheld the District Court, and TVA appealed to the Supreme Court, with Solicitor General J. Howard McGrath insisting that the inferior courts erred in allowing TVA's judgment to be questioned successfully.

Three cases awaiting a determination of whether they will be reviewed involve both the Federal Power Commission and the Securities and Exchange Commission.

In one, the California Oregon Power Co. seeks review of a Ninth Circuit Court Decision which upheld an FPC order requiring the company to make accounting adjustments under the uniform system of accounts totaling $828,684 in excesses over original cost and $636,237 in inter-company profits.

The company's brief noted an FPC assertion that its rule on the case would be considered controlling with respect to its power to order write-off of $1,643,137 in inter-company profits paid by the Oklahoma Gas & Electric Co. and $434,997 in inter-company profits paid by Mountain States Power Co. Thus, California Oregon argued, the case involves $3,543,055. California's appeal was based primarily on FPC's refusal to accept evidence designed to show that the item ruled out as inter-company profits was not actually such an item.

Co-op Case Coming Up

Another appeal from a Circuit Appeals Court ruling upholding an FPC order was brought by the first Iowa Hydro-Electric Cooperative, of Muscatine. Last August, the District of Columbia Circuit Court affirmed an FPC order denying the co-op a license to build a hydro station on the Cedar River, which FPC found to be navigable. The license was denied on the basis that the co-op had not obtained a license from the State Executive Council, in conformity with a state law. The co-op asked the court to rule that no state license is required to build on a navigable stream since, Constitutionally, navigable streams are under the complete jurisdiction of Congress.

SEC was involved in an action brought by a number of common stock holders of

Commonwealth & Southern Corp. who disagreed with an asset-division plan filed by the corporation and approved by the commission. The plan proposed an 85-15 division of assets between preferred and common stockholders, respectively. When it was approved by SEC, the stockholders sought Circuit Court review charging the action was "arbitrary" and without fair hearing, alleging that insufficient evidence was presented to support the finding, that the plan is inequitable to common stockholders, and that the order was not authorized by Congress.

SEC opposed the petition for review and was upheld by the court, which refused to stay execution, so the stockholders sought Supreme Court review.

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Utah Power & Light Co. Hearing Delayed to Jan. 14

Hearing on the Securities and Exchange Commission's petition seeking enforcement of Utah Power & Light Co.'s plan for reorganization was postponed December 14 by Federal District Judge Tillman D. Johnson, Salt Lake City, from December 19 to January 14.

The hearing was delayed because counsel for Electric Power & Light Corp. and an objector, Lazarus S. Heyman, New York City, were unable to be present on the earlier date.

Mr. Heyman, who asserts ownership of 100 shares of $7 preferred stock, objects to the proposed release of Utah Power's claims against Electric Power & Light and assignment to Electric of Utah Power's claims against Electric Bond & Share Co.

He objects also to payment contemplated to Electric of $650,000 for cancellation of 3,000,000 shares of common stock and 2,100 shares of preferred stock held by that company on grounds that the common stock has no potential interest in U. P. & L.'s future earnings. A third objection he made is that the plan, approved by SEC, was not bargained out at "arms length" inasmuch as the Utah company was under control of Electric Power and Electric Bond & Share when the plan was devised.

The same objections were considered in detail by SEC preliminary to approving the plan. One member of the commission dissented from the plan for substantially the same reasons as raised by Mr. Heyman.

Attached to the objections was a copy of a complaint filed by Mr. Heyman in the Federal Court in New York. This suit is directed at early financial transactions between U. P. & L. and its parent companies and seeks to enjoin enforcement of the reorganization plan.

H-F Heating as Tool of Industry Discussed

Use of high-frequency heating by industry as an efficient production tool was discussed by over 500 delegates at a conference held December 3-4, in Los Angeles under the auspices of the Pacific Coast Electrical Association. G. N. Hawley, manager of industrial sales of the Southern California Edison Co., was chairman of the meeting.

H. H. Douglas, of Southern California Edison, speaking to the group, warned against selling industrial electric heating on a competitive fuel basis. "A utility should play a liaison role between the customer and the seller of equipment or service, to the end that the customer gets a well-engineered job and reputable equipment. The application should be made on a sound economic basis," said Mr. Douglas.

Predictions of rapid strides in both induction and dielectric heating were made by Kenneth A. Smith, Electronic Chemical Engineering Co., who said that with high-frequency load doubling every four years and now totaling 350,000 kw. in the United States, possibilities are greater for dielectric heating for sterilization, pasteurization and enzyme control in foods and drugs. Other speakers stressed the fact that high-frequency generating equipment, now idle in southern California because of war contract cancellations, must be put to work by finding uses and users for it.

Additional speakers at the conference were: J. Max Lee, Ajax Electrothermic Corp.; R. W. Steenrod, General Electric Co.; Dr. R. A. Nielson, Westinghouse Electric Corp.; E. S. Winlund, Radio Corporation of America; W. S. Williams, Allis-Chalmers Manufacturing Co.; Harlan A. Messner, Ohio Crankshaft Co.; Fred M. Arnold, Morris Stamping & Manufacturing Co.; Leonard Smith, Leonard Smith Co.; Herman A. Folgner, Handy & Norman.

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Interior Sales for Year Are 17,300,000,000 Kw.-Hr.

Energy sales by the three power marketing agencies of the Interior Department totaled 17,300,000,000 kw.-hr. during the fiscal year ended last June 30, and brought in gross revenues of $45.-500,000, Director Arthur E. Goldschmidt of the Department's Power Division reported.

Generation by the three agencies—the Bureau of Reclamation, Bonneville Power Administration and Southwestern Power Administration — totaled 17,800,000,000 kw.-hr., or nearly nine percent of the national output. The figure represents an increase in output of 14.3 billion kw.-hr. by Interior Department power sources during the last five years. Output of all Interior plants in fiscal 1940 was 3,673,-000,000-kw.-hr. Production during 1945 was about 500,000,000 kw.-hr. above that for the preceding fiscal year. The two Columbia River plants, Bonneville and Grand Coulee, produced about 7,300,-000,000 kw.-hr.

Hydro facilities, including those of the Army Engineers, whose power is marketed by the Interior Department, comprise the largest aggregate of hydro capacity in the world, and represent a power investment of about $425,000,000.

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Mayor Won't Sign Bonds; Camden, O., Goes to Court

Ohio Supreme Court has been asked by Camden, Preble County, to require Mayor Lloyd Townsley to execute a mortgage and sign $111,600 in revenue bonds voted in 1940 for a municipal power plant.

A referendum in 1941 approved the ordinance for the bonds, but construction was prevented by the war. Council amended the ordinance to reduce the interest rate and sold the bonds to Fox, Reusch & Co., Cincinnati, for $106,600.

Petition for referendum was filed on the amended ordinance, but some of the signers subsequently withdrew; so the mayor refused to sign the bonds on the ground that the petitions were invalid. The mandamus suit has the effect of requiring the court to determine whether another referendum should be conducted.

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Utility Offers Scholarships

Portland General Electric Co. has offered 14 scholarships to the 1946 summer school term at Oregon State College for 4-H club members, the awards to be made to one boy and girl in each of the seven Oregon counties in Portland General Electric territory. The scholarships will be joint prizes to the Westinghouse Electric Corp.'s 1946 better farm and home methods electric contest for national 4-H club members.

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FPC Hearing Postponed

The Federal Power Commission has postponed from December 17 to February 4 its hearing to determine reasonableness of the interstate wholesale electric rates charged by the Pennsylvania Water & Power Co. and its wholly owned subsidiary, the Susquehanna Transmission Co. of Maryland.

Arkansas Power Plans $20,000,000 Expansion

New Departments Established to Develop Territory — Transmission Lines Will Be Extended and Automatic Equipment Installed — Rate Studies Look Forward to Further Reductions — Safety Program Started

Details of a $20,000,000 expansion program of Arkansas Power & Light Co. were announced by President C. Hamilton Moses at a recent meeting of the board of directors, officials, division managers, and local managers in Little Rock.

To expedite the program, Hal Fletcher Minnis, operating manager for four years, was named a vice-president and assigned to work jointly with Vice-President R. E. Ritchie.

Included in the expansion program are:

New transmission lines and automatic equipment, as well as increased transformer substation capacities.

More than 3,500 miles of new rural lines to bring the company's total farm customers from 25,000 to more than 50,000.

Continued rate studies looking toward further reductions in line with the more than $25,000,000 in reductions made by the company since 1930.

Creation of an industrial development department to work with various agencies in the state in developing new local and attracting outside industries into company territory.

Creation of an agricultural development department working with various farm agencies in developing higher cash income for farmers through improved planting, harvesting, and marketing methods.

Establishment of an employee training program to rehabilitate returning servicemen and fit present employees for steady advancement.

Establishment of a safety observation program to reduce accident hazards.

Details of the planned improvements to the transmission system were explained by Executive Vice-President C. S. Lynch, who pointed out that the company system is coordinated with the systems of Louisiana Power & Light Co., New Orleans Public Service, and Mississippi Power & Light Co. and is operated as one large system through the load dispatching station in Pine Bluff.

In the Arkansas-Louisiana-Mississippi system, he said, there is about 500,000 kw. of capacity and about 430,000 kw. of load, leaving 70,000 kw. of capacity available for growth while new capacities of 70,000 kw. are under construction.

Vice-President Minnis explained details of the rural electrification program. This involves spending $3,500,000 on lines in 1946, and about $1,000,000 a year in the four years that follow.

Personnel-Director Clyde V. Hussey announced the plans for the employee training program, and the appointment of Reeves E. Ritchie, formerly of Little Rock, as his assistant to help put the program in effect. Included in the program will be a course in executive standards and job training. A course in electronics has been started, and a model distribution system will be constructed for line and maintenance crews to get experience in solving practical problems. Many veterans are being hired.

General Sales Manager P. C. Tucker disclosed that A.P. & L. would not return to the merchandising field but would continue its dealer-company plan by which wholesalers, distributors, and dealers are given assistance in sales programs.

RED DEAN AND DISHWASHER—Visiting the Commonwealth Edison Co.'s Post-war Appliance Show in Chicago, the Very Rev. Hewlett Johnson, dean of Canterbury, England, was particularly interested in the model electric kitchen and its labor saving appliances. The young lady is Rosemary Ward of the Commonwealth Edison Co.

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Phoenix Stockholders Will Guide Policies of Utility

Emphasis on the right of Arizona power-users to guide policies of Central Arizona Power & Light Co. through their recent purchase of 125,000 shares of the utility's 840,000 shares of common stock was highlighted in a joint statement issued recently in Phoenix by the board of directors and a committee of the new common stockholders.

Later, according to a letter sent to Phoenix stockholders by their advisory committee, it was pointed out that "local ownership will bring about a condition of the company which will be more responsive to local needs of the consumers as well as protecting the investments of the stockholders."

Stressing the fact that local citizens have been pledged a counselling voice in the company's affairs to work with the board of directors, it was stated that expansion of the present five-member board would be made at the annual stockholder's meeting next May, by amendment to the articles of incorporation. In the meantime, the letter added that the existing board had assured the committee it would be "delighted to have the assistance, support and advice of the local stockholders."

The increase in purchase of stock in Central Arizona Power by Arizona users stemmed from a campaign which began some months ago by businessmen and civic leaders in Phoenix.

Differential Analyzer Bought for University

An electro-mechanical "brain" has been purchased from General Electric Co. by the University of California for its newly announced College of Engineering at the Los Angeles campus.

Consisting of interconnected systems of shafts, motors and gears, the G. E. differential analyzer employs mechanical elements for addition, subtraction, multiplication and division, and electromechanical elements for more complex functions.

Sixth instrument of its kind in the United States, the new analyzer, now under construction at G. E.'s Research Laboratory at Schenectady, is expected to be placed in service late in 1946. It will be housed in one of the new engineering college buildings to be constructed on the Los Angeles campus.

Although patterned after the five previously made analyzers, from a ten-year old design by Dr. Vannevar Bush, the U.C.L.A. machine will differ from the others in its use of a polaroid photoelectric system of unique design. Fourteen of these highly sensitive devices permit of more accurate, speedy solution of differential equations requiring as many as fourteen simultaneous integrations.

Where previously built machines required that equation curves be followed by moving the input actuating mechanism manually, the U.C.L.A. model does so by means of polaroid photoelectric devices.

According to Dean L. M. K. Boelter of the new College of Engineering, the school to be set up on the Los Angeles campus will be both a student training center and a research facility available on a fee basis to the people, agriculture and industry of the state. One aim will be to provide at least a nucleus where research service and graduate research for industry and agriculture of the state can develop.

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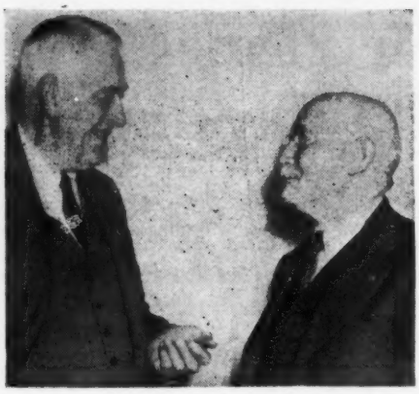
21 States Have Exhausted Quotas for REA Loans

Twenty-one states will have exhausted the quota of funds available for Rural Electrification Administration loans by January 1, REA officials told the National Rural Electric Cooperative Association recently.

The statement was based on allocations already made and on applications received and in process. Under the REA Act, funds available for loans are allotted to states, half on the basis of unelectrified farms in the states and half to be divided equally among states and territories.

It was announced that no new applications are being scheduled for allotment from existing loan funds, which totaled $300,000,000 at the start of the present fiscal year last July 1.

States which will have exhausted their funds by January 1, include Alabama, Colorado, Delaware, Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Minnesota, Missouri, Nebraska, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, South Dakota, Tennessee, and Texas.



THE PRESIDENT GETS A PIN—William B. Skelton, right, president of Central Maine Power Co., receives a 25-year service pin and the congratulations of George S. Williams, vice-president and general manager

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Water Supplies Ample

With the exception of a small area in Southern Arizona and New Mexico, stream flow at the end of November was either normal or excessive. The latter condition prevailed in central and northern California, Oregon, western Nevada, a belt running from eastern Ontario south through the Ohio River basin, Nova Scotia, and southern Florida, where water shortages were serious before the September hurricane. The reports were compiled by the United States Geological Survey and the Dominion Water and Power Bureau.

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Canadian Output Statistics

The Dominion Bureau of Statistics has released the following output statistics of Canadian central electric stations in thousands of kilowatt hours:

Period	1945	1944
Ten months	33,574,912	33,669,980
Primary	27,926,435	30,664,580
Secondary	5,648,477	3,005,400
Exports to U. S.	2,194,922	2,183,930
October	3,309,021	3,482,045
Primary	2,762,459	3,107,635
Secondary	546,562	374,410
Exports to U. S.	224,801	219,303
September	3,079,310	3,234,778
Primary	2,601,286	2,929,316
Secondary	478,024	305,462
Exports to U. S.	215,831	215,617

Expansion at Taunton Will Begin in Spring

Projects aggregating $275,000 will be undertaken next spring on the distribution system and in connection with steam plant auxiliary improvements at the Taunton (Mass.) Municipal Lighting Department, according to a statement made by Chester F. Buckley, manager, to a representative of ELECTRICAL WORLD. The projects include additional 13.2-kv. transmission facilities to the Oak Ridge, Whittenton, and East Taunton substations, additions to the 120/208-volt downtown network, extensions to the underground distribution system, replacement of existing white way street lamps with modern ornamental pendant type units and extension of high intensity pole type units to secondary traffic arteries, installation of a previously authorized switchboard in the Court St. substation, and the installation of an additional circulating pump, changes in the feed water system, additional fuel oil pumping and heating facilities at the West Water St. steam plant.

Authorization has also been given by the department commission under Chairman W. K. Hodgman, Jr., for further engineering study of additional projects, including a change of the distribution system to 2,400/4,160-volt operation, the construction of a new switch house at the West Water St. station, additional service station and laboratory facilities at Mechanics Lane, addional unit type substations and the use of self-supported aerial cables instead of open wire construction in certain portions of the system. In the past five years the total system output has risen from 33 to 60 million kw.-hr.

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Can't Sell Gas to Electric Utility, Seeks Rehearing

Asserting that the sale of natural gas for boiler fuel is a sale for direct, immediate consumption and therefore not under the jurisdiction of the Federal Power Commission, the Northern Natural Gas Co. has asked FPC for a rehearing on its recent order denying the company the right to sell natural gas for boiler fuel to the Iowa Electric Light & Power Co.

The commission denied the authorization on the grounds that coal was available within 75 miles for boiler fuel in the company's Boone station and that sale of gas for such purposes would not be in the public interest.

In addition Northern has filed for a certificate authorizing it to sell natural gas to Iowa for resale to retail customers in Boone. The company is now selling mixed gas to these customers.

American Gas Keeps Old Central System

SEC Permits Retention of Utilities in 7 States Because of Economical Operation and Integration

Because its Central System is well-planned and integrated and economically operated, the American Gas & Electric Co. has been given permission by the Securities and Exchange Commission to retain it and may continue in existence as a registered holding company.

A. G. & E., however, must divest itself of its South Jersey System and its Northeast Pennsylvania System. Included among these properties are Atlantic City Electric Co., Deepwater Operating Co., South Pennsgrove Realty Co., Scranton Electric Co., and West Pittston-Exeter Railroad Co.

The Central System which the holding company will retain includes Appalachian Electric Power Co., Ohio Power Co., Indiana & Michigan Electric Co., Wheeling Electric Co., Kentucky & West Virginia Power Co., Kingsport Utilities Inc., Southern Ohio Public Service Co., Kanawha Valley Power Co., and Beech Bottom Power Co., American Gas & Electric Service Co. and several non-utility subsidiaries may also be retained.

Parts of 7 States Served

The area encompassed is approximately 90,000 square miles and covers parts of Michigan, Indiana, Ohio, West Virginia, Kentucky, Tennessee, and Virginia. Total electric operating revenue for 1944 was $101,758,830.

"The size and extensive area of the utility operations of the Central System," the SEC decision reads, "present in serious form the question whether we can approve it as retainable in its entirety by A. G. & E. The Central System, however, has a long historical record of having been planned, developed, and operated as a highly coordinated system under American's control. Moreover, it does not appear to be so large in any of the states in which it operates as to impair the effectiveness of regulation.

"We note also that we are not being asked to approve the creation of a new holding company over the Central System but merely to determine whether, pursuant to the provisions of Section 11 (b) (1), the status quo is required to be affected. In the instant case, the relatively high degree of coordination of the system's utility facilities and their relatively economical operation, which, in part, appeared to be due to common control, and the other factors noted above, have led us to conclude that the system, as presently constituted, constitutes a single integrated utility system within the meaning of Section 2 (a) (29) (A) of the Act. We are of the opinion, however, that the Central System approaches the maximum size which we believe is consistent with the standards of localized management, efficient operation and effectiveness of regulation contained in Sections 2 (a) (29) and 11 (b) (1)."

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Duke Power Co. Will Add 90,000-Hp. at Cliffside Plant

Duke Power Co. has announced that it will build a 90,000-hp. addition to its Cliffside steam plant which now has a capacity of 110,000 hp. Work will begin this year, and completion is scheduled for early in 1948. The original plant went into operation in 1941. It is located on the Broad River about 40 miles from company headquarters at Charlotte, N. C. New homes will be built in the Cliffside area to house the extra workers needed when the plant opens.

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Sees Large 1946 Market

The air-conditioning and refrigeration industry will have a 1946 market "more than double that of the best pre-war years," Cloud Wampler, president of Carrier Corp., recently predicted. Increased demand for products of the industry will result primarily from two factors, Mr. Wampler stated. He listed them as the large pent-up demand created because of war shortages and increased uses of air-conditioning in a variety of industries and public buildings.

2 P.U.D.'s Still Study Private Utility Sale

Puget Sound Power Negotiations Bog Down as 2 Purchasers Start Independent Survey to Get Facts

Sale of Puget Sound Power & Light Co., Washington State's biggest private utility, into public ownership, appeared stalemated at least temporarily last week as negotiations bogged down under apparent skepticism in two quarters—the Snohomish County and Thurston County public utility districts.

Both had ordered an independent survey of the proposed transaction (ELECTRICAL WORLD, November 17, 1945, Page 7). Although several weeks had elapsed since its completion and despite expressions of confidence from P.U.D. spokesmen that "difficulties" were being ironed out, the two rebel districts still had the results of their own survey "under advisement" last week.

The delay by the two districts appeared to stem from several issues in the bitterly fought transaction, sideline observers and those intimate with details of the deal believed.

One of these was a rumored dissatisfaction with the proposed $60,000,000 price stipulation for the generating and transmission facilities of the private utility which are to be held intact and operated by a "parent" P.U.D.

There was a question in the minds of some commissioners whether the facilities could "pay off" that amount of

REPLICA OF MODEL BARN—Washington Water Power Co. has built for exhibition purposes this replica of the model barn at the University of Idaho's agricultural experiment station at Moscow. It contains a miniature electrical hay drier

money—especially in event of possible future reduction of rates below the $17.50 a kw.-yr. schedule which prevails in the Pacific Northwest, it was said.

It was felt in power circles of the state that the two districts were also skeptical of the overall price of $135,000,000, which would necessarily boost the amount Seattle might be expected to pay to about $35,000,000 (for its share of the facilities in the metropolitan area).

That there was some hesitancy on the part of the two districts to subscribe to the deal because they possibly felt that it was imprudent to continue with negotiations without consulting the city of Seattle was evidenced by a statement by J. N. Erlandsen, Snohomish P.U.D. commissioner.

Speaking before a host of public power champions early in December at the annual convention of the Public Power League of Washington, he said:

". . . the contract was presented to Snohomish County . . . they could not sign before learning something about the deal . . . (it was decided to conduct an independent survey). Thurston decided similarly . . .

"Other matters of reference were absolutely necessary . . . it would be an impossibility for a public agency the size of City Light (Seattle) or Bonneville not to be included in all of the discussions in order for this purchase to go through. . . ."

Erlandsen, long a public power enthusiast, tempered his statement, however, by adding:

"We have too much at stake to be named or regarded as people who would obstruct this deal. . . ." Guy C. Myers, of New York and Seattle, and spokesman for the P.U.D.'s has repeatedly stated that details of the transaction cannot be revealed because it would immediately become a target of private power trusts of the nation. For that reason, it has been stated, Seattle has not yet been consulted.

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Columbia Valley Authority Bills Given to Congress

Sen. Hugh B. Mitchell, Washington Democrat, introduced a modified version of his Columbia Valley Authority Bill as Congress pushed through a heavy prerecess program.

An identical bill was introduced in the House by Rep. Henry M. Jackson, Washington Democrat.

The Legislation would establish a three-member Columbia Valley Authority which would have the authority to generate and sell electric energy, irrigate land, improve navigation, control floods, conserve soil, and protect and improve wildlife and forests.

Charges Alleging Unjust Rates Dismissed by FPC

The Federal Power Commission had dismissed complaints by the city of Oglesby, Ill., and six Illinois corporations alleging that unjust rates were charged by the Illinois-Iowa Power Co., North Counties Hydro-Electric Co., Kewanee Public Service Co., and the Mississippi River Power Co., the latter of Keokuk, Iowa.

The complaint showed that energy sold to the manufacturers was not for resale, thus beyond FPC jurisdiction, while that sold to the city of Oglesby was not shown to have been transmitted in interstate commerce.

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Kentucky Utilities Loses

The Court of Appeals at Frankfort, Ky., has refused to interfere in Paducah's efforts to appraise the property of the Kentucky Utilities Co. which the city wishes to buy.

A motion by the company to dissolve Circuit Judge Joe L. Price's mandatory injunction ordering the company to name its appraiser and for him to join the city's representative in valuing the electric system was denied.

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3 Baltimore Taxpayers Appeal P.S.C. Rate Order

Three taxpayers have petitioned the Circuit Court No. 2 at Baltimore to declare null and void a Maryland Public Service Commission order in which the commission refused to reduce electric and gas rates of the Consolidated Gas, Electric Light & Power Co. of Baltimore (ELECTRICAL WORLD, December 8, Page 139).

The petitioners charge that Baltimore is paying about $600,000 a year too much for street lighting and criticize both the city and the commission for allowing this overcharge. They request the court to set aside the commission's order, to restrain the commission from observing the order, to recognize the suit as an appeal, and to hear all of the testimony presented before the commission, if necessary, to determine a fair rate.

MEETINGS

Pennsylvania Electric Association—Business Development Section—Commercial committee, Pennsylvania Electric Co., Johnstown, Pa., January 10; industrial committee, Roosevelt Hotel, Pittsburgh, Pa., January 10; wiring service committee, West Penn Power Co., Pittsburgh, Pa., January 16; residential committee, William Penn Hotel, Pittsburgh, Pa., January 16-17; customer contact committee, PEA Headquarters, Harrisburg, Pa., January 24. H. S. Metcalfe, chairman of Section, West Penn Power Co., Pittsburgh, Pa.

Illuminating Engineering Society—East Central Regional Conference, Bellevue-Stratford Hotel, Philadelphia, Pa., January 31-February 1. A. H. Manwaring, chairman, Philadelphia Electric & Mfg. Co. 1228 N. 31st St., Philadelphia, Pa.

Previously Listed

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 21-25; Northeastern district, Buffalo, N. Y., April 24-25. H. H. Henline, secretary, 33 W. 39th St., New York 18, N. Y.

Institute of Radio Engineers—Winter technical meeting, Astor Hotel, New York, N. Y., January 23-26. Haraden Pratt, secretary, 330 W. 42nd St., New York 18, N. Y.

National Association of Purchasing Agents—Public Utility Buyers' Group, midwinter convention, Edgewater Beach Hotel, Chicago, Ill., February 4-5. R. C. Wenz, chairman, Philadelphia Co., Pittsburgh 19, Pa.

Pennsylvania Electric Association—Systems operation committee, Roosevelt Hotel, Pittsburgh, Pa., February 6-7; A. R. Deck, chairman, Metropolitan Edison Co., 412 Washington St., Reading, Pa. Transmission and distribution committee, Benjamin Franklin Hotel, Philadelphia, Pa., February 7-8; C. C. Moler, chairman, The Potomac Edison Co., Hagerstown, Md. Electrical equipment committee, Roosevelt Hotel, Pittsburgh, Pa., February 14-15; B. E. Hagy, chairman, Philadelphia Elecric Co., 900 Sansom St., Philadelphia, Pa.

Canadian Electrical Association—Winter conference, Chateau Frontenac, Quebec City, February 11-12. B. C. Fairchild, managing director, 704 Tramways Bldg., Montreal, Canada.

Missouri Valley Electric Association—Power sales conference, Hotel Continental, Kansas City, Mo., February 13-14; engineering conference, Hotel Continental, Kansas City, Mo., April 10-12. I. D. Pettegrew, director, 1004 Baltimore St., Kansas City 6, Mo.

Edison Electric Institute—Transmission and distribution committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 18-19; electrical equipment committee, Netherland Plaza Hotel, Cincinnati, Ohio, February 20-21; general sales conference, Edgewater Beach Hotel, Chicago, Ill., April 2-4. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

American Society for Testing Materials—Spring meeting, Pittsburgh, Pa., February 25—March 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia 2, Pa.

National Rural Electric Cooperative Association—Annual meeting, Buffalo, N. Y., March 4-6. Avery C. Moore, secretary-treasurer, 416 5th St., N. W., Washington 1, D. C.

North Central Electrical Industries—Convention and trade exposition, Radisson Hotel, Minneapolis, Minn., March 10-14. W. A. Ritt, secretary-manager, 234 Foshay Tower, Minneapolis, Minn.

Midwest Power Conference—Annual meeting, Palmer House, Chicago, Ill., April 3-5. S. E. Winston, director Illinois Institute of Technology, Chicago 16, Ill.

National Electrical Manufacturers Association—Spring meeting, Palmer House, Chicago, Ill., week of April 8. W. J. Donald, managing director, 155 E. 44th St., New York 17, N. Y.

Electrochemical Society—Spring meeting, Tutwiler Hotel, Birmingham, Ala., April 10-13. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York 27, N. Y.

National Electrical Wholesalers Association—Annual convention, Stevens Hotel, Chicago, Ill., April 21-25. C. G. Pyle, managing director, 500 Fifth Ave., New York, N. Y.

International Lighting Exposition—Stevens Hotel, Chicago, Ill., April 25-30. A. B. Coffman, manager, 111 W. Jackson Blvd., Chicago 54, Ill.

Cheaper Power for Shirt Firm Upheld by Council

If citizens of Kinston, N. C., don't like the contract that the city made with the Lenoir Shirt Co. during the depression granting the company concessions on its power rates, they will have to bring suit and enjoin the City Council from fulfilling it.

This was the stand taken recently by the Council, which voted to comply with the terms of the contract which gives the shirt company a rebate of $83.33 monthly until the contract expires on June 30, 1948.

Under the contract the shirt company must provide employment for a minimum of 250 persons. But a group of citizens says that now the depression is over and that the city has no legal right to continue the concession. The citizens want the city to submit the case to the Superior Court to determine the legality of the contract. This the Council has refused to do.

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System Buy Approved

Acquisition of all the electric facilities of Public Utilities California Corp. by the California Oregon Power Co. for $175,000 has been authorized by the Federal Power Commission.

The facilities are located in Del Norte County, Calif., and will require a 25-mile interconnection to reach the purchaser's system. California and Oregon Commissions approved the transaction.

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Reverts to Old Name

The Public Power League of Washington has reverted to its former name, Public Ownership League of Washington. The change was made at the recent convention in Seattle because it was felt that the old name more clearly represents the purpose of the league to conserve and develop the reserves of the state through ownership by citizens of public utilities required by the public interest.

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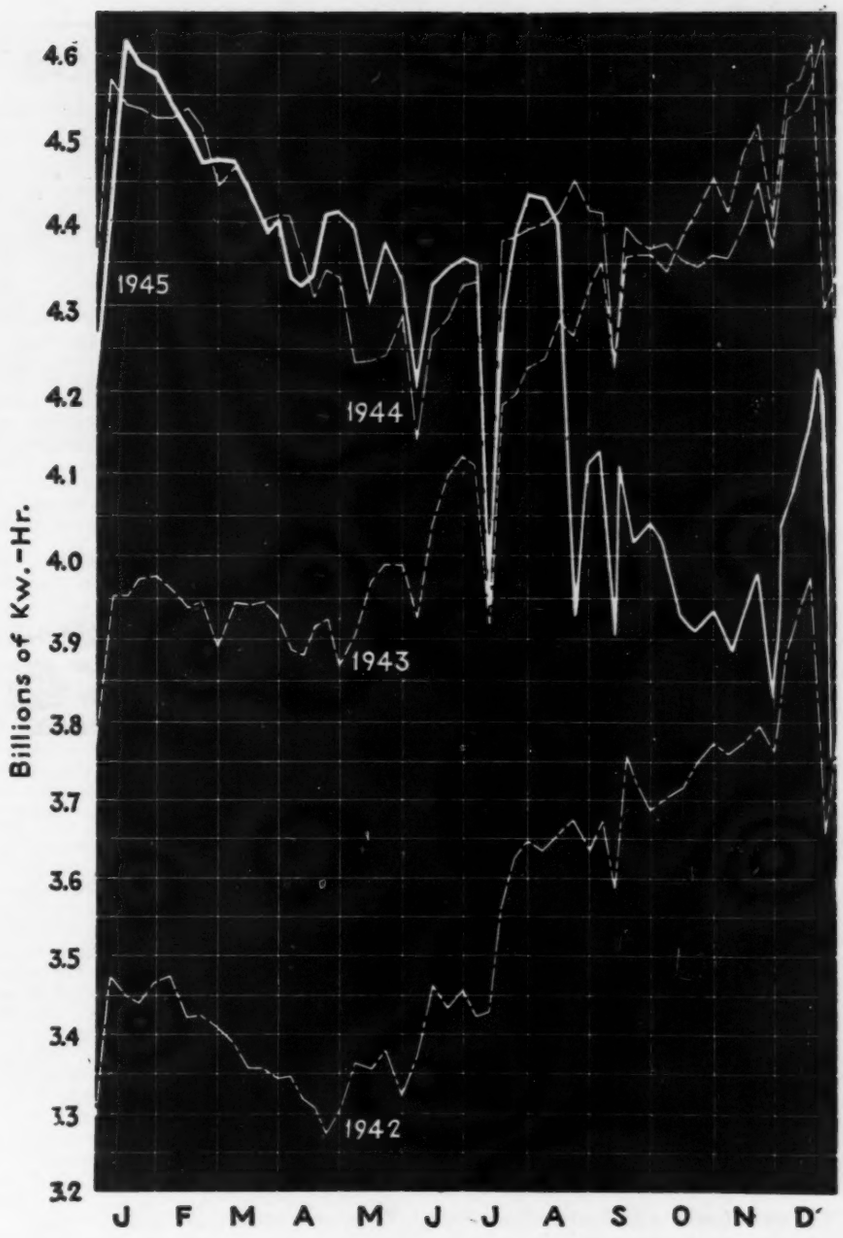
Won't Make or Sell Power

Kewanee, Ill., voters on December 12 rejected a proposition to establish a municipal power plant, voting 1,646 for and 3,614 against, and a companion proposition to permit the city to sell electric current, 1,535 for and 3,525 against. Kewanee Public Service Co., which now serves Kewanee, has a franchise which will expire in four years.



Electric Output Curve Drops Sharply

The electric output curve during the week ended December 29, 1945, reversed the upward trend of the past few weeks, dropping sharply, according to an estimate made by the Edison Electric Institute. Final figures, delayed by the New Year's holiday, will be published in the January 12 issue.

E.E.I. placed the estimated amount of electrical energy distributed by the light and power industry for the week ended December 29 at 3,720,000,000 kw.-hr., compared with 4,239,376,000 kw.-hr. during the preceding week. During the week ended December 30, 1944, the amount of electrical energy distributed amounted to 4,225,814,000 kw.-hr., this year's estimated figure representing a decrease of 12.0 percent.

Weekly Output Millions Kw.-Hr.

1945		1944		1943	
Dec. 29	3,720	Dec. 30	4,226	Jan. 1	4,337
Dec. 22	4,239	Dec. 23	4,617	Dec. 25	4,295
Dec. 15	4,154	Dec. 16	4,563	Dec. 18	4,613
Dec. 8	4,097	Dec. 9	4,538	Dec. 11	4,567
Dec. 1	4,043	Dec. 2	4,524	Dec. 4	4,560
Nov. 24	3,841	Nov. 25	4,369	Nov. 27	4,403
Nov. 17	3,985	Nov. 18	4,450	Nov. 20	4,513
Nov. 10	3,948	Nov. 11	4,397	Nov. 13	4,483
Nov. 3	3,899	Nov. 4	4,355	Nov. 6	4,414
Oct. 27	3,937	Oct. 28	4,358	Oct. 30	4,453
Oct. 20	3,915	Oct. 21	4,345	Oct. 23	4,415
Oct. 13	3,931	Oct. 14	4,355	Oct. 16	4,382

Percent Change from Previous Year

	Week Ending		
	Dec. 29	Dec. 22	Dec. 15
New England	— 0.6	— 3.2	
Mid Atlantic	— 2.4	— 2.7	
Central Industrial	— 10.8	— 11.4	
West Central	— 0.2	— 1.7	
Southern States	— 11.4	— 12.3	
Rocky Mountain	— 0.5	— 1.3	
Pacific Coast	— 9.8	— 10.8	
Total United States	—12.0	— 8.2	— 9.0

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission recently issued a series of orders affecting electric utility companies.

PROVINCETOWN LIGHT & POWER CO.'s proposed sale of 175 shares of additional common stock at $100 a share to its parent, New England Gas & Electric Association, has been approved by the commission. Proceeds of $17,500 will be used by Provincetown to pay off existing indebtedness to the First National Bank of Boston of $17,500, incurred for extensions, additions and improvements to its plants and property. (Release No. 6316).

CENTRAL STATES POWER & LIGHT CORP.'s proposal for a 30 percent liquidating payment upon its $831,960 publicly-held 5 percent debentures was not ruled upon by the commission, but the board did grant an extension of the maturity date of all of the $5,940,000 outstanding debentures from January 1, 1946, to January 1, 1947. The balance of the debentures are owned by Ogden Corp., which controls Central States Utilities Corp., which, in turn, controls Central States Power & Light. The latter is in process of liquidation. (Release No. 6310).

CENTRAL NEW YORK POWER CORP. has been granted permission to borrow $1,900,000 from the Guaranty Trust Co. of New York at 1¾ percent interest. This sum is to be used, together with corporate cash, to purchase in the open market all or part of the $1,901,000 non-callable first mortgage 5 percent bonds of 1951 of the Syracuse Lighting Co., predecessor. (Release No. 6307).

INTERNATIONAL HYDRO-ELECTRIC SYSTEM trustee, Bartholomew A. Brickley's application for an order exempting from certain rules under the Holding Company Act his proposed payment of $100,000 to Gatineau Power Co. has been granted. The payment is being made in consideration of the release by Gatineau of certain litigation and claims against International Paper Co. (Release No. 6302).

CENTRAL HUDSON GAS & ELECTRIC CORP.'s application for an order declaring that the company is not a subsidiary of United Corp. has been granted because Niagara Hudson Power Corp., intermediate holding company in the United Corp. system, recently disposed of all of its holdings of Central Hudson. (Release No. 6304).

LACLEDE GAS LIGHT CO. legal fees, totaling $57,561, incurred in connection with a recent plan providing among other things for the sale of the electric properties of its subsidiary, Laclede Power & Light Co., dissolution of that company and recapitalization of Laclede Gas and the sale of Ogden Corp.'s common stock interest in that company have been released from SEC jurisdiction. (Release No. 6306).

CONSOLIDATED ELECTRIC & GAS CO. and its subsidiary, the Maine Public Service Co.'s joint application, whereby the latter would sell at competitive bidding $3,200,000 of first mortgage and collateral trust bonds, increase its present authorized capital stock and acquire its common stock now held by Consolidated, has been approved. Maine Public Service would change its present authorized capital stock of 10,000 shares of $100 par value to 150,000 of $10 par value. The 150,000 new shares then would be issued and exchanged with Consolidated for its present holdings of the common stock of Maine Public Service, listed as 9,303 shares. Proceeds from the sale of the bonds, which the commission stipulated could not be sold until the results of competitive bidding had been made a matter of record, would be combined with other corporate funds and money to be retrieved for the New Brunswick Electrical Power Co., Ltd., a subsidiary of Maine Public Service. The commission also reserved jurisdiction over the payment of legal fees and expenses in connection with the transactions and revised to "not less than six days" the period allowed for solicitation of bids for the bonds. (Release No. 6308).

MIDDLE WEST CORP., its subsidiary, the Central and South West Utilities Co., the latter's subsidiary, the Central Power & Light Co. of Massachusetts, and the newly organized Central Power & Light Co. of Texas received endorsement of the SEC on a series of transactions which they proposed. Under the terms approved, Central of Massachusetts will be dissolved after selling its properties and business to Central of Texas, refunding its serial notes and retiring by redemption or exchange all of its outstanding 7 and 6 percent preferred stocks. (Release No. 6296).

AMERICAN UTILITIES SERVICE CORP.'s proposal to comply with the commission's order of June, 1944, by selling its interests in the Wisconsin Southern Gas Co. to H. K. Harley and R. M. Haydon of Madison, Wis., for $410,000, has been sanctioned. The transaction involves all 3,000 outstanding $100 par value common shares of Wisconsin and the latter's unsecured 6 percent income note for $150,000 dated February 1, 1940, and due February 1, 1950. The note is pledged with Harris Trust and Savings Bank of Chicago and American will deliver $150,000 of the proceeds from the sale to the bank and will add the balance to its general corporate funds. Upon consummation of the sale, the purchasers plan to sell 40 percent of their investment to K. D. Knoblock of Chicago and 20 percent to Carl Altenbern of Burlington, Wis.

FLORIDA POWER CO.'s proposed sale of gas properties to the Savannah-St. Augustine Gas Co. for a base price of $1,165,000 has been sanctioned by the SEC, which released jurisdiction. Florida Power is a subsidiary of the General Gas & Electric Corp. In 1943 the commission granted applications whereby the Florida Public Service Co., Sanford Gas Co. and the Santa Fe Land Co., all subsidiaries of General Gas & Electric, were merged into Florida Power. The SEC stipulated, however, that within one year of the merger Florida Power should divest itself of all water, gas and ice properties owned by it, other than the ice plant in Orlando, Fla., the water properties servicing Winter Garden, Fla., and all land obtained as the result of the merger of the Santa Fe Land Co. The commission said sale of the gas properties marked compliance with its order. The only change listed in the proposed sale was a $45,000 reduction from the original price of $1,210,000. (Release No. 6292).

Hearings Scheduled

JANUARY 15: To consider the proposal of United Gas Improvement Co. to exchange certain portfolio securities for not to exceed 750,000 shares of its own outstanding capital stock. (Release No. 6300).

JANUARY 17: On proposed sale by Pennsylvania Electric Co. of gas manufacturing, transmission, distribution and sale facilities in Clearfield, Lockhaven, Renova and East Renova, Pa., to John H. Ware, 3rd, of Oxford, Pa. The hearing was postponed from January 7. (Release No. 6314).

UTILITY REPORTS

	Net Income 1945	1944
‡American Power & Light and subs	$13,754,855	$13,696,232
*Central Arizona Light & Power	903,779	734,088
*Connecticut Light & Power	4,046,567	3,836,278
*Detroit Edison and subs	6,879,500	7,084,237
‡Electric Power & Light and subs	12,019,293	6,062,806
*New Orleans Public Service	1,982,447	1,744,655
†Southwestern Public Service	1,518,413	1,789,665
*Texas Power & Light	2,610,469	2,512,952

*Twelve months ended November 30.
†Twelve months ended October 31.
‡Twelve months ended September 30.

Tidal Power Too Costly Canadian Report Shows

A recent report made in the House of Commons at Ottawa showed that power from a tidal hydroelectric plant harnessing the Bay of Fundy tides would be approximately eight times as expensive as power from a coal burning steam plant. The report was prepared by H. G. Acres & Co., consulting engineers, Niagara Falls.

Including the capital investment, $155,667,485 for a tidal plant and $35,000,000 for a steam plant, the report showed that tidal power would cost 5.47 cents per kw.-hr. and steam 0.691 cents.

Pay Raise for Wiremen May Be Coast Precedent

Under the terms of a new agreement between union wiremen and Fresno Electrical Contractors Association in Fresno, Kings, Tulare and Madera Counties of California, wiremen will receive $2 per hour on a basic 7-hour day, with a slightly changed overtime wage scale. The contract will be effective when approved by the Wage Adjustment Board, or when federal controls are lifted, whichever occurs first.

The raise represents a 17.6 percent increase over the former $1.70 hourly pay, and is expected to spread all along the West Coast.

Overtime for the eighth hour of any regular working day and all day Saturday will be paid on a time and a half basis, instead of the double time now paid.

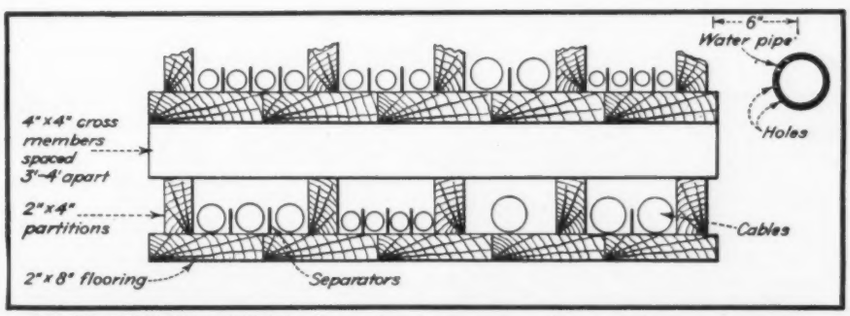
HOW

DESIGN · CONSTRUCT · OPERATE · MAINTAIN

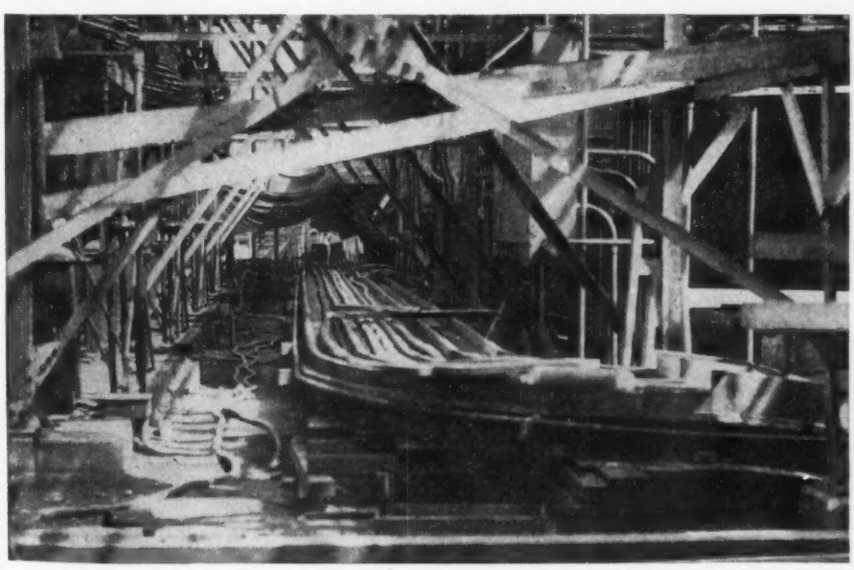
Carry Power Cables on Tiered Troughs

RAY S. KIBLER
Chief Engineer, Central Illinois Electric & Gas Co., Rockford, Illinois

Work currently in progress by Stone & Webster Engineering Corp. at Rockford generating station of the Central Illinois Electric & Gas Co., incident to the addition there of two new 20,000-kw. turbo-generator units and boilers, has made it necessary to reroute 20 cable circuits through the substation yard. Until new duct lines can be built the existing cables will be operated in wooden troughs, one above the other, as shown. Special provision has been made in erecting the troughs to provide air circulation between tiers and for deluging the racks with water in event of fire.



CROSS SECTION SKETCH shows how temporary cable troughs are arranged



CABLE TROUGHS carry power circuits through substations yard while duct line is being rerouted. Note water pipe line along trough for fire protection

With the exception of a single 13-kv. circuit all the cables involved operate at 4 kv. and range in size from 1,000,000 cir. mil single-conductor to 250,000 cir. mil three-conductor. Most of it is 20 years old and so will not be returned to operation at the original voltage when the new ducts are completed, although the cable appeared to be in excellent condition. Instead, entirely new cable will be pulled into the new duct.

Troughs consist of a floor of 2-in. by 8-in. planks divided into longitudinal compartments by 2-in. by 4-in. timbers set on edge. Cross members, 4 in. by 4 in., laid across the tray at 3- to 4-ft. intervals, provide an air space above the cable in each tier for necessary ventilation. They also support floor timbers of the next tier above.

Particular care was taken to provide separators between adjacent cable sheaths to prevent sheath currents from migrating from one cable to another and causing damage to the sheaths where they touch.

For fire protection 1½-in. pipe with holes drilled at intervals along its length has been run along both sides of the temporary cable racks and connected to water mains through valves so that rack may be flooded with water in event of a fire.

Meter Jewel Holder Speeds Inspection

W. H. PARMITER
Superintendent of Meters
Connecticut Power Co., Stamford

CLOSE-UP OF JIG, microscope and bars used in pivot and jewel inspection. Viewing the hand-held bars, left to right, appear a bar for pivot holding, a bar for the reception of newer type jewels, and a bar for carrying jewels of the older type. Since this photograph was made, the company has abandoned the use of the nebulizer and adopted the L & R cleaning machine as more efficient

Slow and tedious manual handling of meter jewels and pivots during inspection has been eliminated by a special device developed by the Connecticut Power Co., Stamford. With the aid of this equipment it is feasible with one adjustment of the microscope to inspect an unlimited number of jewels, turning them to any desired angle without touching them. The apparatus consists essentially of a jig which fits into the bed of the microscope and into which any one of a series of bars holding a number of jewels or pivots of one size may be placed. The jig allows the bar to be tilted laterally or axially about the jewel as a center, thus having the jewel in focus at all times. A spring-actuated tapered plunger engaging notches on the side of the bar allows successive jewels to be slid quickly and accurately into the field of view.

Each bar has holes or pockets of correct size and depth to allow the jewel or pivot to be in focus. These pockets are spaced so that imperfect jewels may be removed from the bar and discarded as soon as inspected. The perfect jewels remain in the bar and are all removed in one operation. The number of jewels in each bar is determined by a convenient bar length. Since the center of radii of the bearing surface of the jewel or pivot coincides with the intersection of the two axes of the jig, the surface to be inspected is at all times the same distance from the microscope and thus in focus. Each jewel is brought to the same relative position, making it unnecessary to readjust the microscope. Beyond the saving of time and labor is a reduction in eye fatigue.

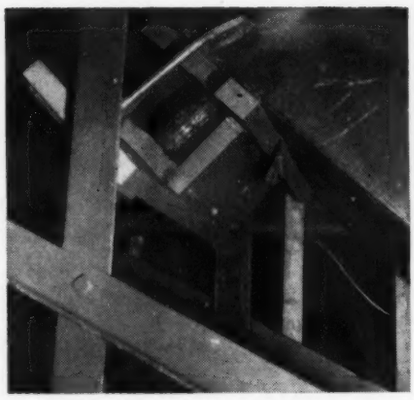
•

Spilled Coal Now Not Manually Shoveled

Ingenuity on the part of the staff at the Front Street station of the Pennsylvania Electric Co. at Erie, Pa., has eliminated the necessity of handling 5 to 10 tons of spilled coal hourly. This task was often encountered while passing wet coal on the conveyor belt, particularly at the point that the coal falls from one conveyor belt onto a second which runs at right angles to the first.

CONVERGING-SLOPING chute leads into vertical chute. Both are made of 3/16-in. cold rolled steel

The coal, being wet, clung to the first belt just long enough to miss the second belt and fell to the floor. Consequently, it had to be shoveled by hand onto the second belt.



MAGNET under sloping chute made of old elevator-motor field coil

To eliminate this, two chutes were built. One is a converging-sloping chute, which leads into another, a vertical chute, and thereby passes the coal which formerly fell to the floor directly into a bunker below. However, this could not be done until some means had been found of "sifting" out the bolts, nuts, etc., often present in the coal.

A magnet was made from the field coil of an old elevator-motor and welded to the sloping chute as illustrated. It is energized by a 220-volt motor-generator set and has diverted up to 50 lb. of iron per day that would otherwise have fallen into the bunker.

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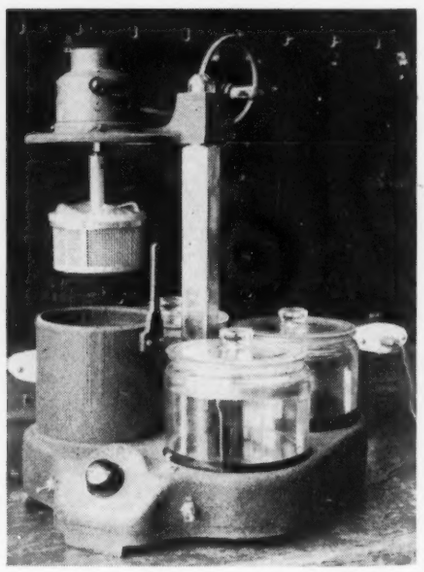
"Washing Machine" Saves Time Cleaning Meter Parts



METER PARTS placed in metal basket are spun in solvent solution, rinsed and dried in this industrial cleaner

Slow and not too satisfactory, the tooth brush and solvent method of

cleaning demand registers and other meter parts has given way to the cleaning machine illustrated in the Oakland meter shop of Pacific Gas & Electric Co., in charge of L. D. Tycer. The equipment, known as an L & R industrial cleaning machine, has been in service about a year.

A variable - speed, motor - driven meshed wire basket containing an inner finer meshed basket for holding the parts is revolved first in a cleaning solution, then in a first rinse, then a second rinse and then dried in a metal container with electrically heated fan circulated air. If desired, a thermostatically operated speed control may be switched in so that the basket alternately spins fast and then slow to give a washing machine agitation action.

Badly gummed registers, bearings and various meter parts that formerly required 1½ to 2 hours to clean by hand are now more effectively cleaned in about 20 minutes.

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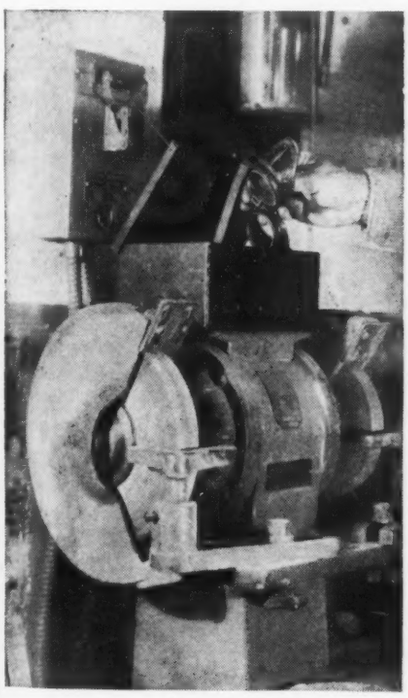
Container Invites Safety

A. O. MANGOLD, *Safety Engineer*
Northwestern Electric Co., Portland, Ore.



CLOSING SWITCH to start grinder motor automatically opens goggle box

A steel box mounted on grinder motor as shown serves as a convenient, substantial and somewhat dustproof receptacle for safety goggles worn by workmen when using the grinder. An added feature is a short rod attached to the box top and the switch handle so that when the starting switch is closed the box lid is raised and automatically invites the workman to put on his goggles for safety's sake. In addition, a poster with appropriate message, which is changed from time to time, is pasted inside the box cover to catch the eye of the workman as a further reminder.

• • •

Bank Transformers in Single-Pole Cluster

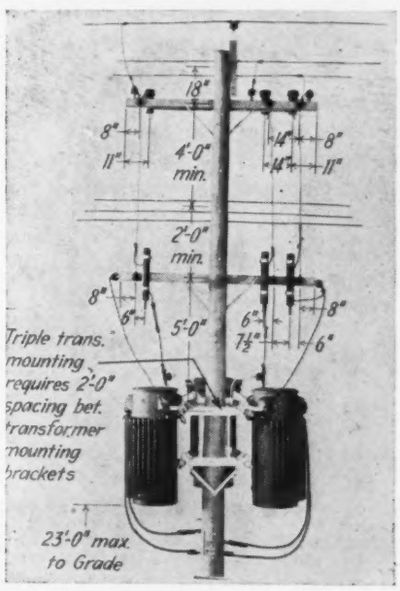
HOWARD P. SEELYE, *Senior Engineer, The Detroit Edison Co., Detroit, Mich.*

Until recently Detroit Edison Co. has mounted 150-kva., three-phase transformer banks and larger on two-pole platforms or individual units on adjacent poles. More recently, and particularly where space is restricted, three single-phase transformers of such three-phase banks have been mounted in a "cluster" on a single pole, as shown. The transformers are equally spaced around the pole on a triangular steel bracket so that the load on the pole is symmetrical.

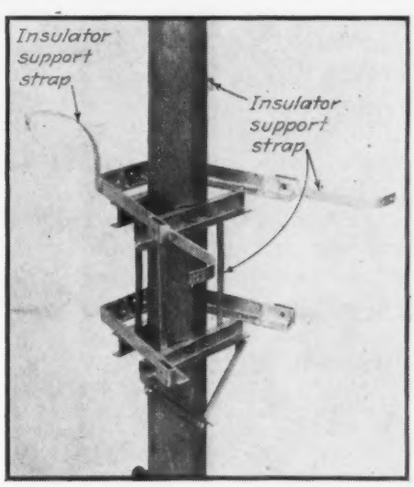
The arrangement lends itself to any size bank up to three 100-kva. units of the modern steel case type. Overall dimension of the maximum 300-kva. three-phase bank is 96 in. which is the length of the crossarm used to support primary conductors and transformer trainers. The transformer mounting bracket, in addition to supporting the transformers, also carried supports for training the transformer leads. The standard E.E.I. single-bolt transformer mounting arrangement is used.

This "cluster" arrangement of transformers, in addition to providing a compact arrangement for use in streets and alleys where space is limited, also affords a considerable cost saving over conventional platform mounting.

This was suggested by George Hindman of the Overhead lines department.



TRANSFORMER cluster installation

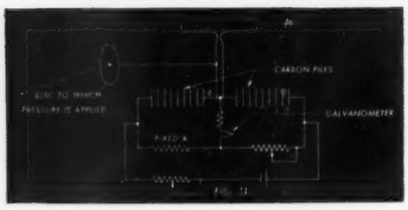


TRIANGULAR mounting bracket used to support transformer cluster. Note insulator support straps to which trainers are attached; one is hidden

BANK of three 100-kva. transformers mounted in triangular cluster on single pole cuts cost, saves space

Instrument Reveals O.C.B. Tank Pressures

A. R. MILLER
Development Engineer
Roller-Smith Co., Bethlehem, Pa.



CIRCUIT DIAGRAM of carbon-pile pressure gage used in breaker tests

One of the questions encountered in designing a new series of oil circuit breakers was how to measure the internal pressures of the tank and record them by an oscillograph. This information is vital to determination of the stress to which a switch tank is subjected during and immediately following the interruption of the circuit.

We have used for this purpose, and with great success, a variation of the telephone transmitter. A plug containing a 1-in. disk is screwed into the base of the tank and pressure variations are transmitted to a Wheatstone bridge. Two arms of the bridge are made up of very small disks of hard carbon which have the property of varying their resistance proportionally to the movement of the arm applying the pressure. This is similar to the action of a telephone transmitter.

With this arrangement, when pressure is applied to the diaphragm, the carbon pile resistances are varied and this gives the galvanometer a current reading which is directly proportional to the pressure applied to the diaphragm. This can be recorded on an oscillogram along with the current and voltage curves.

In certain instances these oscillograms will show the impulse pressure applied to the tank by the interruption of the arc as well as the reflected pressure wave. When this occurs, the record will reveal a pressure "build-up" of approximately twice the incident wave. These will be followed by pressure waves sweeping back and forth across the tank, each decreasing in magnitude. This instrument was used on tests of the company's new Exotherm series of oil breakers and recorded internal pressure up to 40 psi. during the arc quenching period.

• • •

Jig Eases Lifting of Primary Metering Grid

WILLIAM H. WAY
Philadelphia Electric Co.

JIG TO LIFT PRIMARY TRANSFORMER METERING GRID is shown (at left) in open position before being slipped over the transformer grid, (center) in closed position as if holding the grid, and (at right) holding the grid and ready for lifting

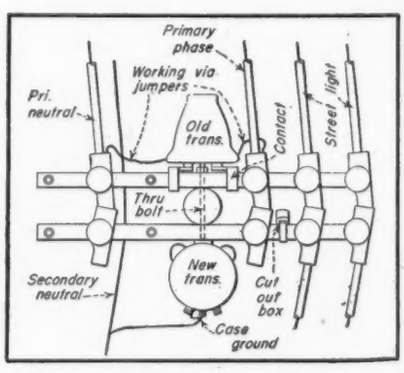
Jig to lift primary metering transformer grids from the ground to their installed position in outdoor pole mounted cabinets without changing pulley blocks or their position on the grid or without having the lineman lift the grid into position in the cabinet is now being used by the Philadelphia Electric Co. Its use provides a much safer method of installing the grid since it eliminates the necessity of the lineman's reaching out and lifting the grid into the previously mounted cabinet. It also saves about two hours per installation.

It is made with six pieces of $\frac{1}{4}$ by 1-in. strap iron, a $\frac{1}{2}$-in. formed iron pipe which acts as the pulley block rope guide, and a $\frac{3}{4}$-in. iron spacer bar to which the pulley block is attached for raising and lowering.

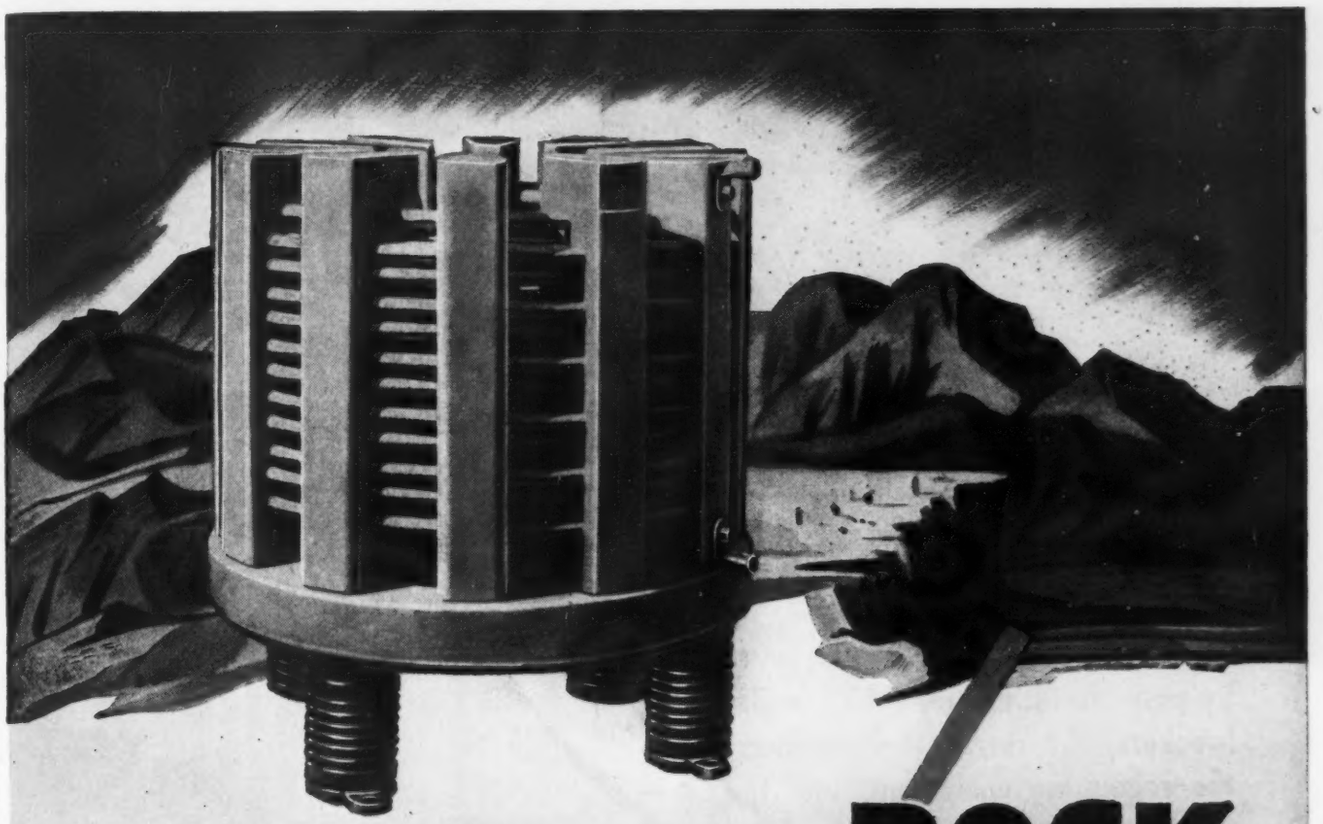
In use the jig is positioned over the middle of the grid, the two bottom iron supports are swung around so that the two bottom strap-iron fingers slide behind the current transformer support at the bottom and then the whole jig is pushed down so that the two top strap-iron fingers slide behind the potential transformer support at the top. The jig is then bolted together in this position. Only two side bolts have to be loosened or tightened to open or close the jig. The rope is passed inside the iron pipe yoke-member and the lower pulley block is attached to the $\frac{3}{4}$-in. spacer bar. The jig-held grid is now ready for raising to its position in the pole mounted cabinet.

To Avoid Accident from Multiple Grounds

An analysis of a pole top accident, recently made by the Liberty Mutual Insurance Co., Boston, developed that procedure in distribution transformer replacements deserves to be carefully planned. In this case, a transformer was being superseded by one with a through-bolt hanger and hung on the opposite side of the pole from the original installation. This made necessary the relocation of the cut-out box. The taps were disconnected from the box and the live-line phase tap rolled up under the hood. The position of the cut-out box was changed to that shown. During the straightening of the primary tap to connect it to the cut-out in its new position,



PLAN OF POLE TOP transformer arrangement and line tap connection which contributed to accident



Solid as a ROCK

. . . AND JUST AS WEATHER RESISTANT!

An installation of 120-kva cast-in-concrete reactors made in 1925, each giving a 3 per-cent reactive drop in a 22,000-volt 3-phase circuit.

Cast-in-concrete reactors in metal enclosure, where the degree of reliability required warrants shielding from external causes of failure.

CAST-IN-CONCRETE
CURRENT-LIMITING
REACTORS

Service records of thousands of G-E reactors prove that CAST-IN-CONCRETE CONSTRUCTION is hard to beat for mechanical and electrical strength, non-inflammability, resistance to weathering.

1. STRENGTH—Conductor and concrete become a one-piece structure, having strength and rigidity to withstand short-circuit magnetic forces.

2. HIGH FLASHOVER VOLTAGE—Good clearances, elimination of through bolts, use of asbestos conductor covering, and large porcelain insulators give maximum assurance against flashover between turns and layers, and against flashover of complete unit to ground.

3. LONG SERVICE LIFE—Materials used in these reactors are selected by G.E. especially for weatherproof qualities. All are fireproof and practically imperishable, making possible a co-ordinated design having both an excellence of performance and extraordinarily long life. Special treatment during finishing process renders them highly moisture resistant.

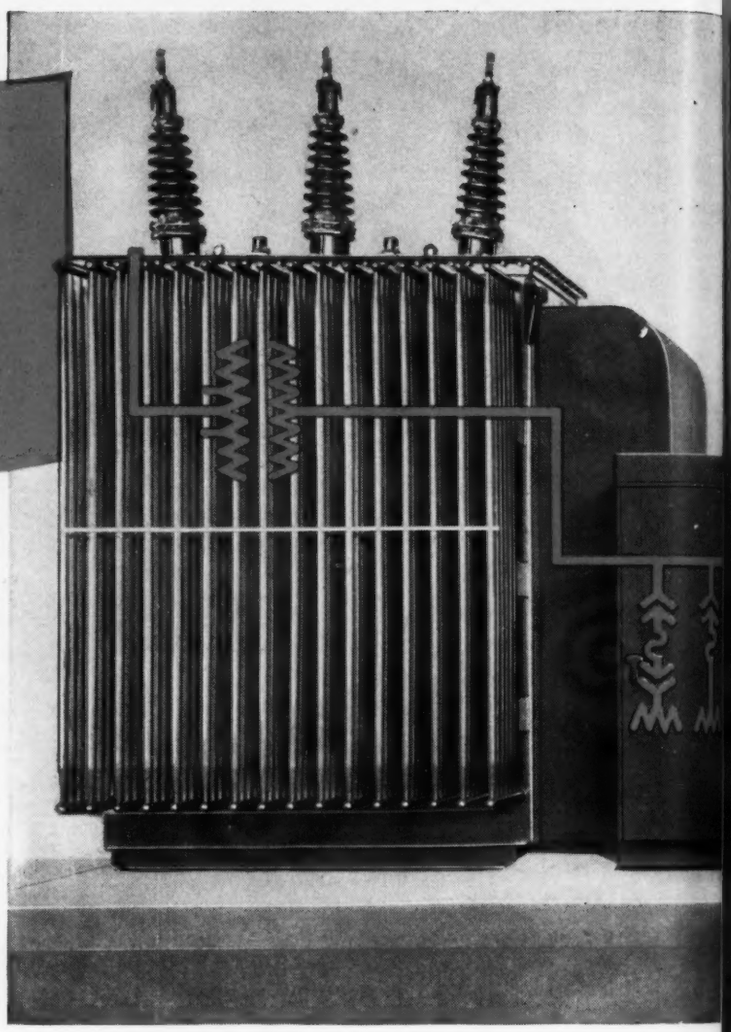
4. FOR DIVERSE REQUIREMENTS—G-E cast-in-concrete reactors may be obtained in either single- or three-phase designs, and in a number of arrangements to meet installation requirements for indoor and outdoor service. They can also be obtained with metal-clad construction (steel cabinet) to match switchgear equipment.

For details, ask your local G-E representative or write for Bulletin GEA-976B. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

401-36-5188

NOW 3 more BUILT-IN FUNCTIONS



1. **Individual feeder regulation**
2. **By-pass facilities for the feeder breakers, the current transformers, the regulating equipment, and the power transformers**
3. **Two complete power-supply paths to each of the outgoing feeders**

This new master DUPLEX unit substation affords increased flexibility as to both substation design and function, together with a high degree of continuity of service. Where individual feeder regulation and by-pass facilities are required, the DUPLEX provides the way to do the job at remarkably low cost.

The DUPLEX unit is especially well suited to locations where continuity of service is of prime importance, because:

- **It is completely automatic in operation**
- **Its operation is not dependent upon the correct operation of other units**
- **It is capable of maintaining, through either transformer, the total load normally carried by both**

Don't overlook the fact that the DUPLEX is a standard G-E unit substation. Your over-all installed cost is low, and it is definitely predictable, because:

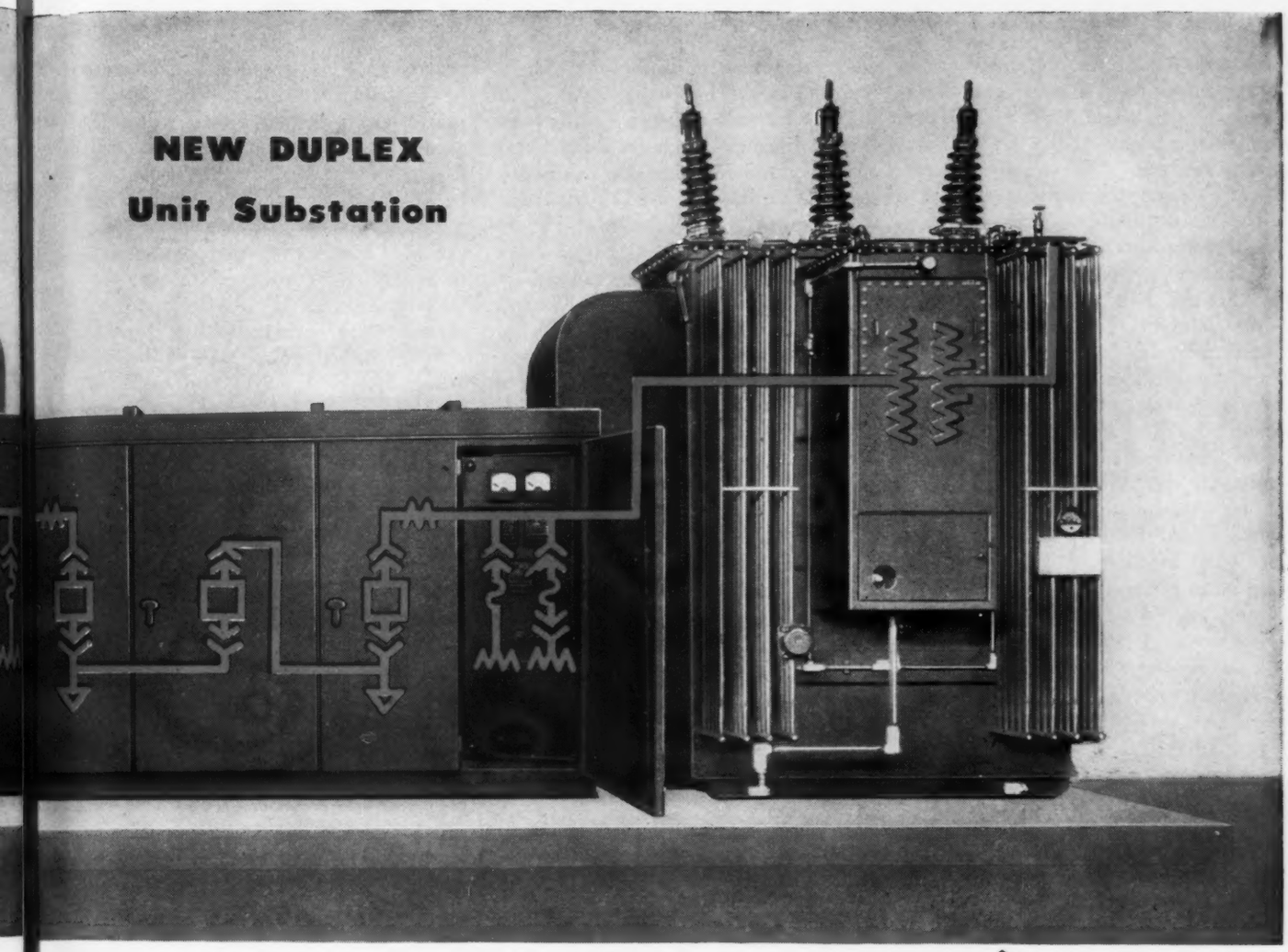
- **The DUPLEX is standard equipment**
- **It is repetitively manufactured**
- **It is completely assembled for you at the factory**

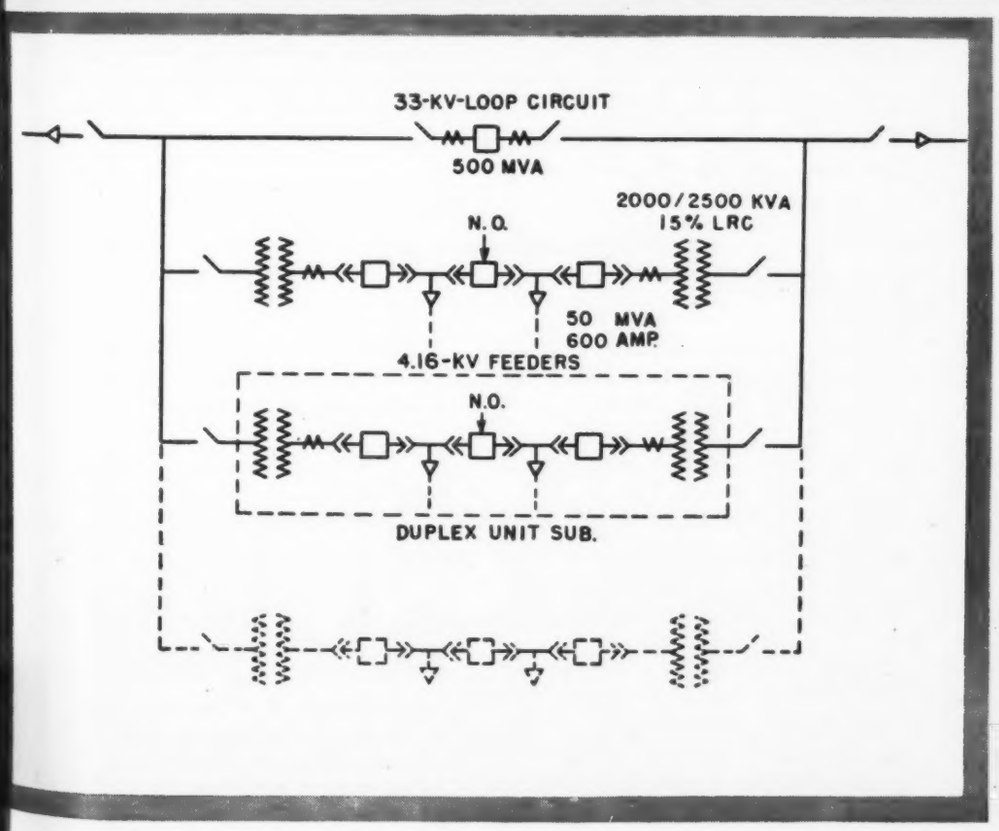
The DUPLEX unit substation can be used separately or in conjunction with identical units to make a substation with a total capacity as large as 20,000 kva. It is compact, easy to install, and easy to move.

Your local G-E sales engineer will be glad to give you further information. Ask him for a copy of Bulletin GEA-4478. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

321-50-5900





Relaying is so arranged that, if voltage disappears at the secondary of one transformer, the breaker on that side immediately opens and the tie breaker automatically closes, restoring service in approximately 105 cycles.

The DUPLEX provides a "building block" approach to the construction of standard substations which have a degree of operating flexibility heretofore obtained only by special engineering and construction. Small or large substations can be economically made up of the same basic unit. A single DUPLEX unit can be installed at first, and as the load grows, additional units can be added when they are needed.

GE

UNIT SUBSTATIONS

the tap contacted the old transformer hanger, grounding the primary phase wire. The resultant flash caused the lineman to withdraw his hand quickly, and in so doing he struck his left elbow, chipping the bone.

The transformer case ground on the old transformer had been removed, but the case was still grounded by the through bolt of the new transformer hanger. The case of the new transformer was grounded. The lesson of the accident was to do as much work as possible with the line dead when connecting equipment, check the connections, and finally connect to the line itself. In this instance the tap to the cut-out should have been disconnected from the line while the cut-out box location and connections were being changed. Transformer-case grounds should be connected only after all other work has been completed, and the existence of multiple grounds carefully avoided.

•

Safer Right-of-Way Working Methods

In an eastern utility system during a field survey for a high-tension line right-of-way, a serious job hazard was revealed of which the employees knew nothing beforehand. A crew of eight linemen were clearing brush and had been working in a large swampy section when they soon broke out with an infection on legs and arms. All the crew was affected and one man had such a bad case that he had to quit work for a week. An examination of the various types of bushes in the area showed that a large amount of poison sumac was present. In order that the linemen could learn quickly to recognize poison sumac, a sample of the plant's leaves, berries and stock was mounted in a box with a transparent cover and sent around to each division of the company for exhibition. A survey was also made of the entire right-of-way and the areas where the poison plants were found were noted. The worst areas were designated by painted signs indicating the extent of the area, and at the approach to each area several bushes were tagged and marked "Poison Sumac." As a result every lineman has learned to recognize the bushes and take the necessary precautions. No cases of sumac poisoning have been reported in the line department since.

Other hazards of brush cutting have caused linemen much trouble. Cases of injury and lost time have occurred resulting from hernia, strained backs, sprained ankles, eye injuries and punctured ear drums. Hernia and back strains were due to or aggravated by constant pulling on the scythe. Eye and ear injuries were due to ends of bushes striking against the head and entering the eyes or ears. A crew man often turns his head sidewise to protect his eyes and in so doing exposes his ear so that a twig is apt to enter it when he is using the scythe. It has been recommended that all such employees be furnished with a special type of plastic eye protector which will safeguard the eyes and make it unnecessary to turn the head sidewise. These will be available after the war, and in the meantime lopping shears have been provided for cutting large bushes and have proved very successful in preventing injuries formerly caused by scythe work. Considerable trouble with 20-ft. extension ladders having a low factor of safety and made of inferior grades of wood has been eliminated by a change in side rail specifications which increased the strength by over 38 percent.

• • •

Uninsulated Guys Afford Lightning Protection

Two uninsulated guys used as ground wires and connected to a horizontal stabilizing guy between the two outside poles of a 3-pole H-frame afford the conductors lightning protection at the structure.

This type of construction, which is contained in the recently revised standards of the New York State Electric & Gas Corp., Binghamton, N. Y., utilizes only standard hardware.

Lower guys pass in comparatively close proximity to the conductors and therefore are conventionally insulated. Dimensions on the accompanying sketch show the grounded guy to be 8 ft. 3 in. above the conductor.

The two outside poles also carry the conventional over-head ground wires which are connected to the grounded guys through the pole bands.

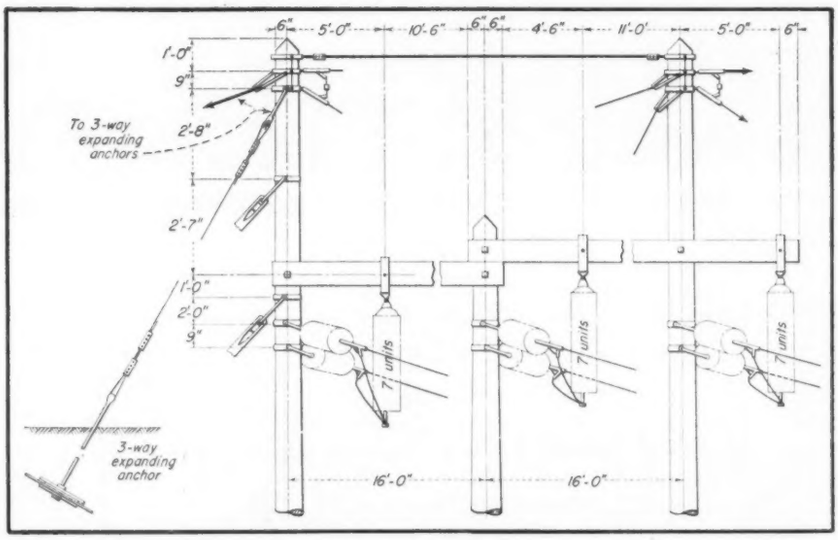


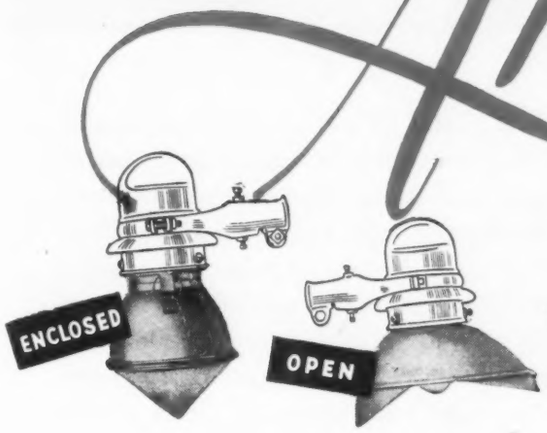
FIG. 2—Details of guying, method of interconnecting pole bands and uninsulated guy wire to conductor clearance are shown for 3-pole H-frame structure

FIG. 1—7/16-in. H. S. Bethanized steel guy wire between two poles of H-frame is connected to insulatorless guys to afford a static guy loop around the transmission line structure

GE Announces

A Basic Advance in SUBURBAN STREETLIGHTING

Two new reflectors-- using 1000- to 2500-lumen lamps



These two new reflectors (open and enclosed) are the "better sight" successors to the radial-wave reflector for light-traffic and residential streets — the suburban streets.

When equipped with the new G-E 2500-lumen series lamps of 5⅜-inch light-center length and spaced as recommended, these new reflectors make it practical and economical to meet I.E.S. Standards for suburban streets.

For the first time, they bring scientific light control into the field of minimum-cost street-lighting.

Full details on these new reflectors can be obtained by calling your local G-E office. Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

Adaptable to your present hoods and insulators, they furnish greatly improved visibility as unit-for-unit replacements of radial-wave reflectors.

ARE YOU TYING IN WITH THE NEMA PLAN TO GIVE AMERICA BETTER STREET LIGHTING? REMEMBER . . .

Good Street Lighting Builds Good Will!

STREET LIGHTS *for Better Seeing*

GENERAL ELECTRIC

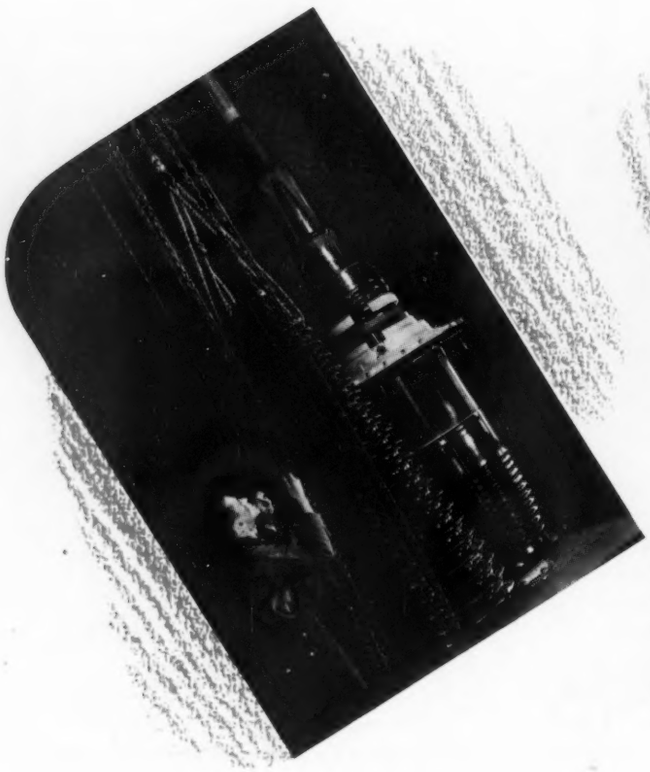
452-38-3010

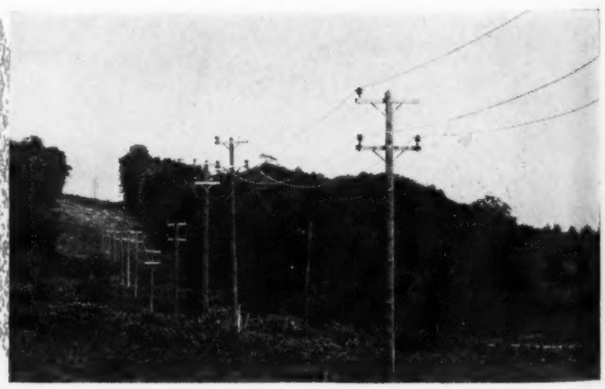
Correct to Start With --and Stays That Way

DOES HARDWARE ever loose its strength? Yes! Here's how--if corrosion attacks it, every cross section is slowly but surely reduced. Metal put there for a safety factor disappears, and so does that safety factor. Then we begin losing that margin of strength we *know* we need, until some unusual stress exceeds the capacity of the remaining metal. This, in short, is the story of corrosion. Regardless of design or any other advantage, if the metal itself isn't durable, neither will be the service that piece is supposed to render.

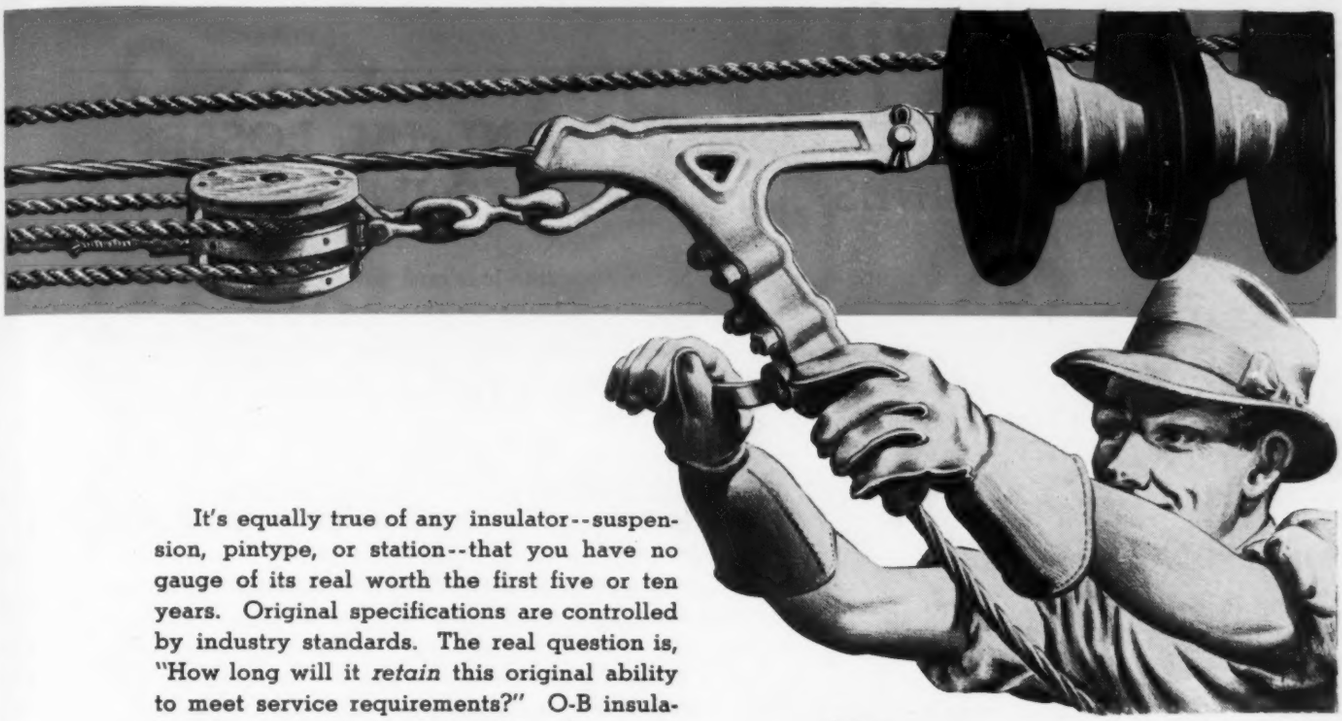
O-B high-voltage hardware is cast in malleable iron for three sound reasons. (1) It has a desirable ratio of strength, ductility, and weight. (2) Because the molten metal is highly fluid, it comes out true to mold in complex and precise shapes not attainable by other methods of fabrication. (3) due to a unique property of *cast* ferrous metals, the surface coating of rust forms a permanent natural protection that positively stops all further corrosion. Malleable iron brings you these three vital qualities. It is strong and ductile. It can be shaped to true functional design without compromises. It retains its shape, its size, and its strength because it does not corrode.

Suspending a charged conductor is basically a mechanical job, and one that must go on indefinitely. For this purpose, specify O-B line hardware that is correct to start with--and stays that way.

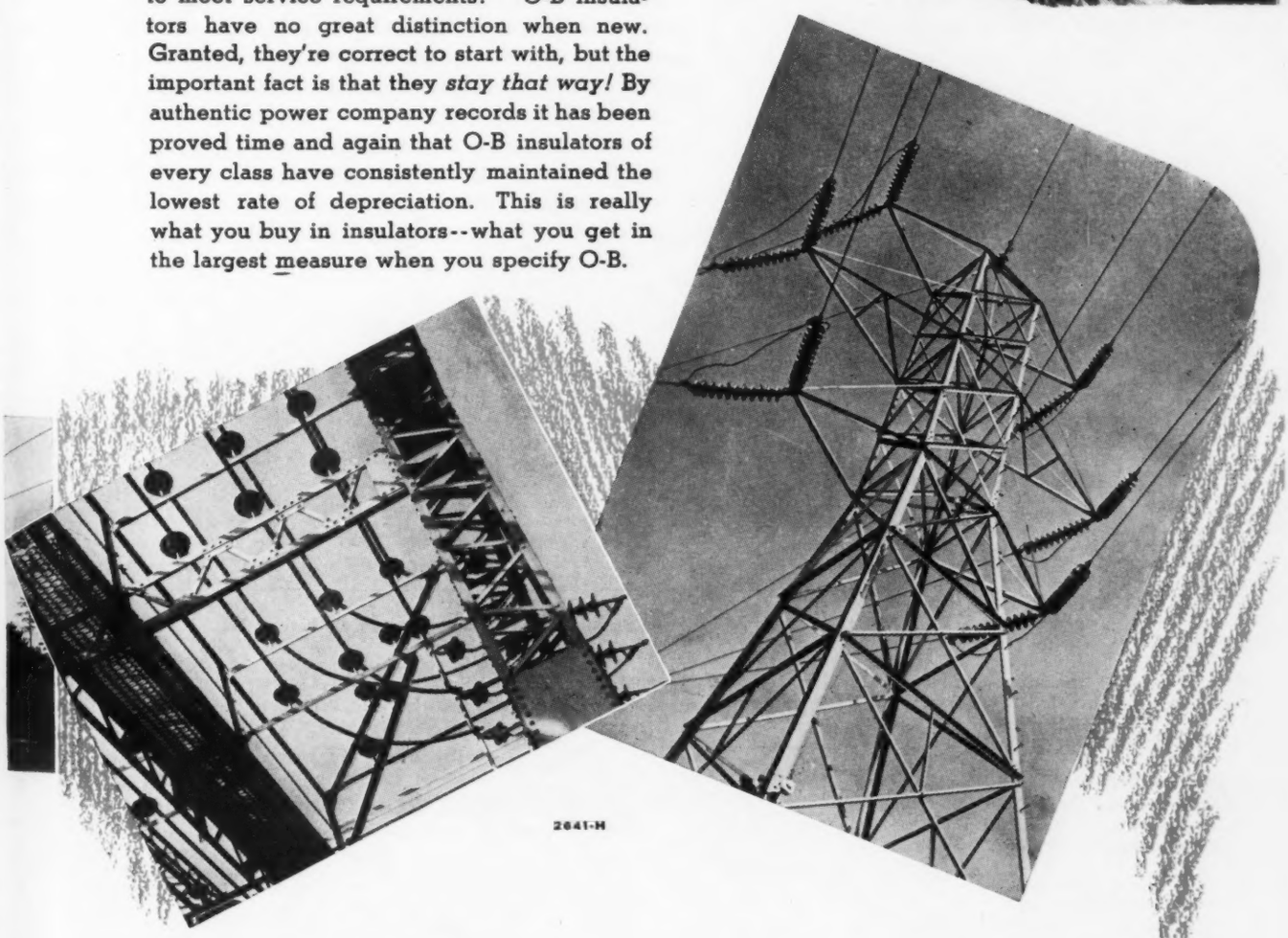




Again, O-B's durability shows up in bushing design. Internal dielectric is porcelain--porcelain you have learned through years of experience to trust in any high-voltage insulation job. Only with O-B bushings can you get porcelain internal dielectric and, for this same reason, only with O-B bushings can you get the long, trouble-free performance that naturally goes with porcelain insulation.



It's equally true of any insulator--suspension, pintype, or station--that you have no gauge of its real worth the first five or ten years. Original specifications are controlled by industry standards. The real question is, "How long will it *retain* this original ability to meet service requirements?" O-B insulators have no great distinction when new. Granted, they're correct to start with, but the important fact is that they *stay that way!* By authentic power company records it has been proved time and again that O-B insulators of every class have consistently maintained the lowest rate of depreciation. This is really what you buy in insulators--what you get in the largest measure when you specify O-B.



2641-H

Ohio Brass

MANSFIELD, OHIO
CANADIAN OHIO BRASS COMPANY, LIMITED
NIAGARA FALLS, ONTARIO

A METHOD TO COMPUTE ANNUAL LOSSES ON LINES AND TRANSFORMERS

Two separate formulas are used to compute line loss and power transformer loss. Curve is used for the relation between load factor and equivalent hours; some actual percentage values are tabulated for convenience. This computation method is an adaptation of engineering practice of Birmingham (Ala.) Electric Co.

LINE LOSS

Formula:

$$L_L = \left(\frac{KW}{PF \times 1.73 \times V}\right)^2 \times 0.2628\, lr\, H_E$$

where

L_L = Annual line loss, in kw.-hr.
KW = Maximum load, in kw.
PF = Power factor of load
V = Line voltage, in kv.
l = Length of line, in thousands of feet
r = Resistance of conductor per thousand feet, in ohms
H_E = Equivalent hours, in percent

Example:

Maximum load = 2000 kw.
Power factor of load = 0.8
Line voltage = 13.2 kv.
Length of line = 10,000 ft.
Size of conductor = No. 2/0
Resistance of conductor = 0.0821 ohms per thousand feet
Load factor = 50 percent
From curve, for 50 percent load factor the equivalent hours is 33 percent.
By substituting in the formula:
Annual line loss =

$$\left(\frac{2000}{0.80 \times 1.73 \times 13.2}\right)^2 \times 0.2628 \times 10 \times 0.0821 \times 33$$

L_L = 85,200 kw.-hr.

TRANSFORMER LOSS

Formula:

$$L_T = 87.6\left[100\,C + H_E\left(\frac{M}{K}\right)^2 F\right]$$

where

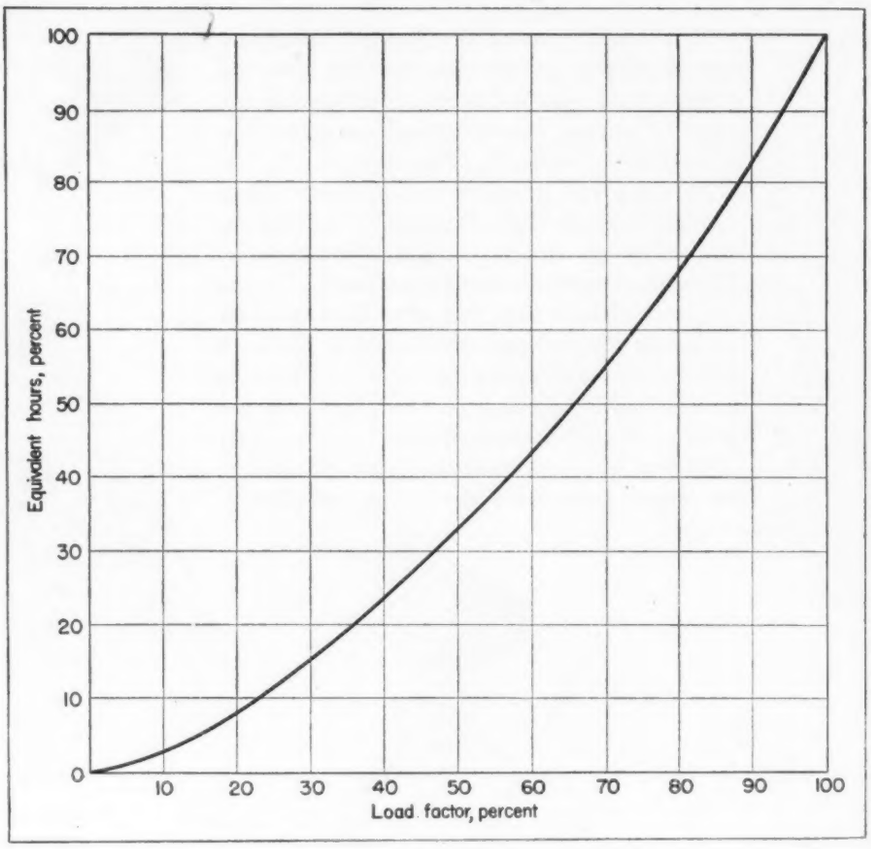
L_T = Annual transformer loss, in kw.-hr.
K = Capacity of transformer, in kva.
M = Maximum load on transformer, in kva.
C = Core loss of transformer, in kw.
F = Copper loss of transformer at full load, in kw.
H_E = Equivalent hours, in percent

Example:

Transformer data—
Capacity = 500 kva.
Maximum load = 400 kva.
Core loss = 17 kw.
Copper loss = 48 kw.
Load factor = 60 percent
From curve, for 60 percent load factor the equivalent hours is 44 percent.
By substituting in the formula:
Annual transformer losses =

$$87.6\left[100 \times 17 + 44\left(\frac{400}{500}\right)^2 \times 48\right]$$

L_T = 267,000 kw.-hr.



CURVE gives approximate relation of load factor and equivalent hours

NOTE: *Equivalent hours as shown on the graph, for load factors above 75 percent and below 30 percent, are to be used as rough approximations only*

CURVE PROJECTION POINTS

Load Factor, percent	Equiv. Hours, percent	Load Factor, percent	Equiv. Hours, percent
100	100	50	33
95	91	45	28
90	83	40	23
85	75	35	19
80	68	30	15
75	61	25	12
70	55	20	8
65	49	15	6
60	44	10	3
55	38	5	1

★★★★4 OF THE 1008 METROPOLITAN ELECTRICAL UNITS *in* RADIO CITY

COMPLETE ELECTRICAL CONTROL by

At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards
Circuit Breaker Switchboards
Dead Front Switchboards
Battery Charging Switchboards
Motor Control Switchboards
Explosion-proof Switchboards
Laboratory and Test Switchboards
Control Switchboards
Generator and Distribution Switchboards

ESTABLISHED 1892 METROPOLITAN TRADE MARK

ELECTRIC MANUFACTURING COMPANY

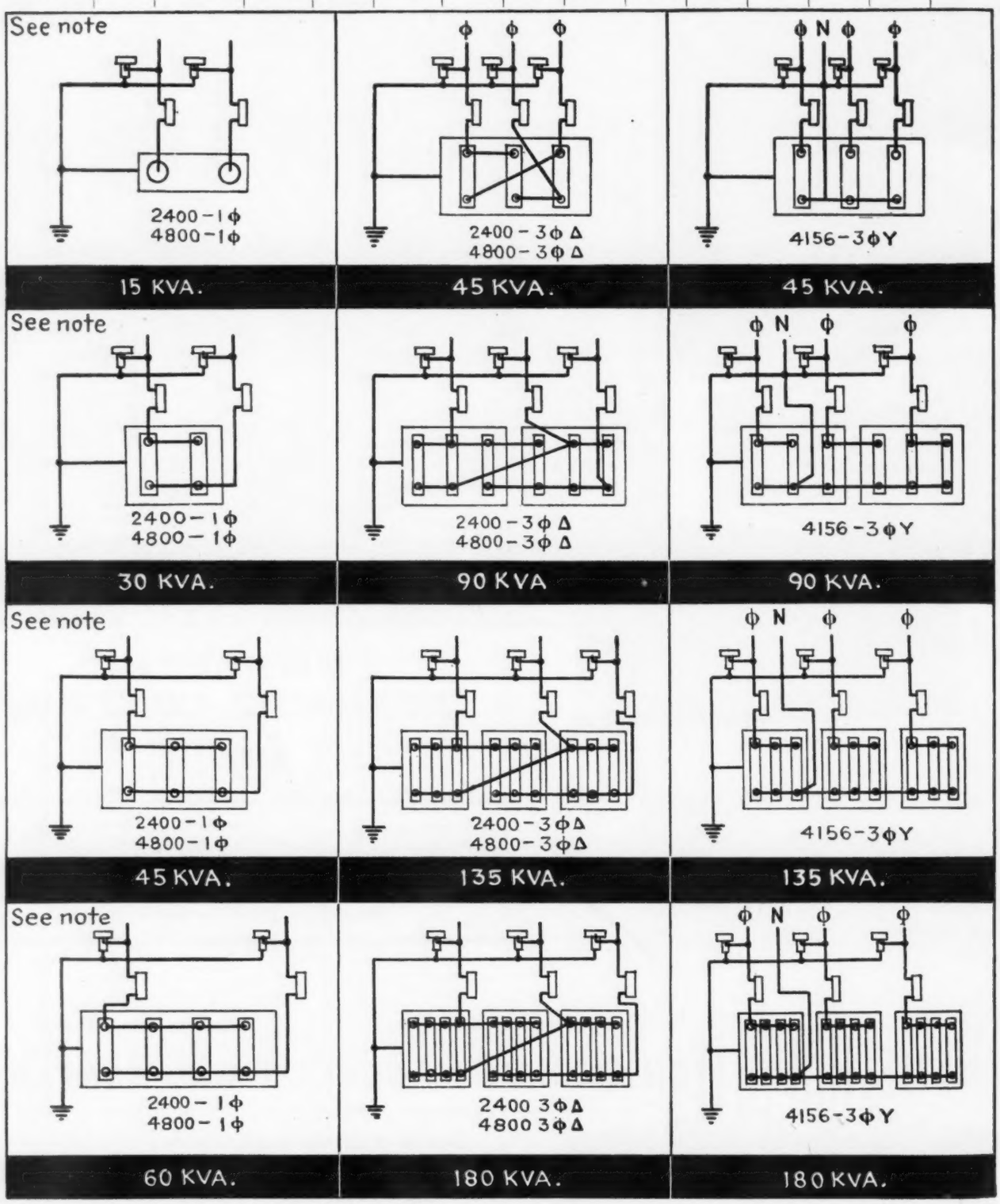
ELECTRIC LIGHTING AND POWER
DISTRIBUTION EQUIPMENT
LONG ISLAND CITY, NEW YORK

How to CONNECT and FUSE CAPACITORS

Diagrams show external connections and table lists kind and size of cutouts and capacity of fuses for shunt-type capacitors used on distribution circuits. These are adapted from a book of standard practices of Central Hudson Gas and Electric Corp., Poughkeepsie, N. Y.

SIZE OF CUTOUTS AND FUSES FOR CAPACITORS

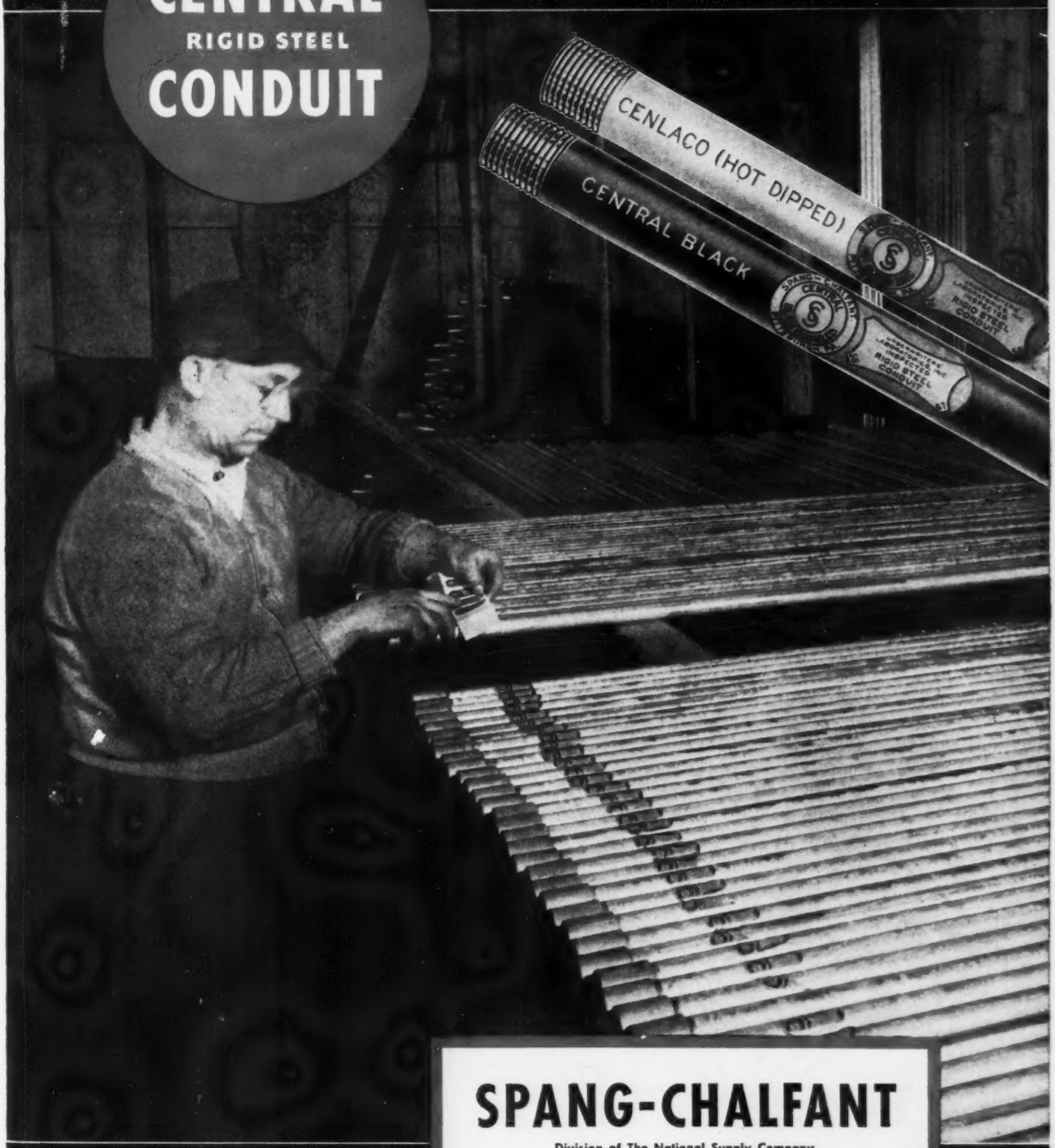
Capacitor Size, kva.	Cutout		2400 v., 1 ϕ		4800 v., 1 ϕ		2400 v., 2 ϕ		2400 v., 3 ϕ		4156 v., 3 ϕ		4800 v., 3 ϕ	
	Amp.	Style	Pri. Amp.	*Fuse *Amp.	Pri. Amp.	*Fuse *Amp.	Pri. Amp.	Fuse Amp.	Pri. Amp.	Fuse Amp.	Pri. Amp.	Fuse Amp.	Pri. Amp.	Fuse Amp.
15	60	Dropout	6.25	15	3	8	....	....	....	....	....	....	....	....
30	60	Dropout	12.5	25	6.25	15	....	....	....	....	....	....	....	....
45	60	Dropout	18.75	40	9.4	25	9.4	25	10.8	25	6.2	15	5.4	15
60	60	Dropout	25	50	12.5	25	....	....	....	....	....	....	....	....
90	60	Dropout	.....	....	.....	....	18.7	40	21.6	40	12.5	25	10.8	25
135	100	Dropout	.....	....	.....	....	28	50	32.5	85	18.7	40	16	40
180	100	D. & W.	.....	....	.....	....	37.5	100	43.4	100	25	50	21.6	50



Note: Omit cutout and arrester from neutral on phase and neutral lines.

Final Assurance

that **CENTRAL** RIGID STEEL **CONDUIT** is the finest you can buy



"There's Tested Strength in Every Length"

SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

District Offices and Sales Representatives in Principal Cities

Distribution Staff Duties Summarized*

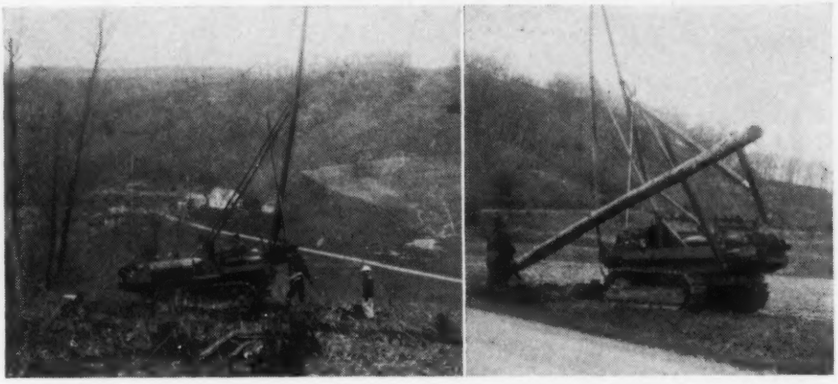
Technical Assistant—Special Tests and Records

This staff member's responsibilities include the maintenance of network protectors and certain other network apparatus as described under special instructions covering such equipment; keeping a record of all tools as required in detailed regulations of the department; entering on a service recorder chart the name of associated automobile driver for the corresponding running period, with proper endorsement by the department head to which the motor vehicle is assigned, and the filing of these charts by car number and date. He is also responsible for the annual compilation of statistics required by the return to the state regulatory commission and the Federal Power Commission.

Each January this technical assistant examines all regular operating records to determine if they are being accurately maintained and properly kept up to date, giving attention to any records needing it. He is required to make such checks as he may find necessary at such intervals as may be required to determine if all records of periodic operations are being kept up to date, especially the typing and entries on pole cards. A similar function is performed on periodic jobs requiring considerable time to complete, and which would not be the subject of a periodical work report until finished, such as pole painting, pole butt inspections, meter testing, transformer inspection, periodic voltage tests, etc. The results of such checking are reported to the superintendent of distribution at suitable intervals. If it is found that records of periodic operations are not being kept up to date, the attempt is made to remedy this, with a report to the superintendent if unable to do so. Special attention is here paid to the work of the meter service department. This system is not intended to duplicate the periodic work record system or to check the methods employed in doing work. Department heads are expected to co-operate to the full with

* One of a series of presentations covering the essential duties of officials of a public utility distribution department serving between 50,000 and 75,000 meters. Organization of the distribution department was outlined in ELECTRICAL WORLD, October 13, 1945, page 106.

Dig And Set Pole in Seven Minutes

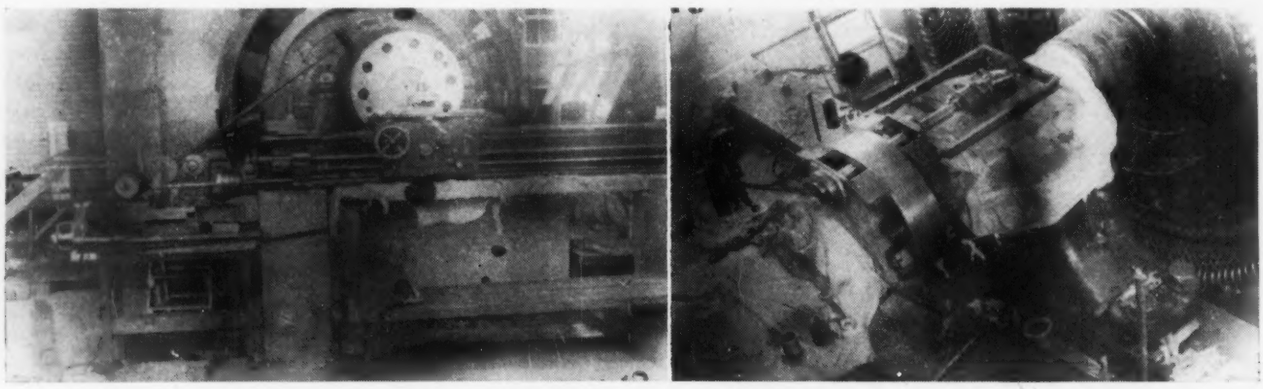


MULTI-PURPOSE TRACTOR mounting digger, 24-ft. A-frame derrick and double-drum winch used by L. E. Myers Construction Co. for transmission construction in rough Wisconsin country. A hole was dug, and a pre-assembled 69-kv. pole was set in seven minutes by a 3-man crew. The D-7 tractor mounts a type HC digger

Lathe Set Up to Face Large Coupling Flanges

In the major overhaul of a 12,000-kw. frequency changer set by Southern California Edison Co. it became necessary to reface and true up the large coupling flanges on the two rotors. Suitable concrete piers were erected on the station floor and the two center bearings and pedestals, removed from the set, were placed on the piers, leveled and centered. A 57-in. spur gear was mounted on the outboard end of the rotor shaft and a worm gear fitted to the bottom of the spur gear. A 10-hp. motor belted to the shaft of the worm gear turned the rotor 4½ rpm.

Facing of the couplings was then accomplished with an 8-ft. bed lathe mounted on concrete piers as shown. Coupling bolt holes were rebored after the machine was reassembled by an air motor driven drill mounted in suitable supporting frame as illustrated. The entire overhaul which included reinsulating of the machine was done under the direction of R. K. Klumb, superintendent of Vestal substation.



BED LATHE (LEFT) MOUNTED on concrete piers is used for refacing coupling flanges of frequency changer set undergoing overhaul. Bolt holes (right) were rebored with rotors in place by air operated, hand fed drill

You can't beat the *Nicopress* method of making Dead-ends

1. They are designed for use on copper, Copperweld and Copperweld-copper conductors.
2. They can be installed on pin, strain or spool insulators.
3. Simplicity and speed of installation.
4. Strength and tightness.
5. Provide for tail of any desired length.
6. No extra tools are required to make the offset dead end, as the same tool used in making regular line splices will do the job . . . These convenient Nicopress tools are small and compact and are extremely easy to operate close to the insulators or cross arms.

THE NATIONAL TELEPHONE SUPPLY COMPANY

The National Telephone Supply Company

5100 SUPERIOR AVENUE • CLEVELAND 3, OHIO

Canadian Mfr.: N. SLATER CO., LTD., HAMILTON, ONTARIO, CANADA

Export Distributor: INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

There's a

SCHRAMM

AIR COMPRESSOR

. . . for your every need!

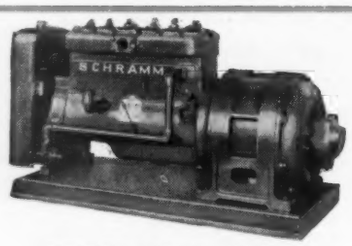
SIZES RANGING FROM 2 TO 600 CU. FT. DISPLACEMENT

DIRECT DRIVE ON BASE

Built-in Motor Drive mounted on steel base is compact and easy to install. No foundations necessary.

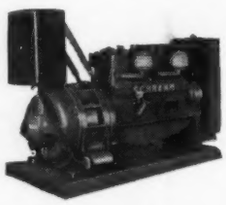
WITH "V" GROOVE PULLEY

Schramm Belt Driven Compressors can be obtained with "V" or flat belt drive suitable for twenty-four hour service and economical operation.



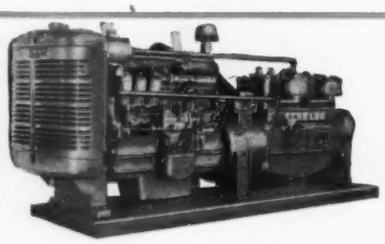
DIRECT MOTOR DRIVE WITH COOLING UNIT

Schramm 300 cu. ft. displacement with direct-connected 50 H.P. motor with cooling unit on Steel Deck Base.



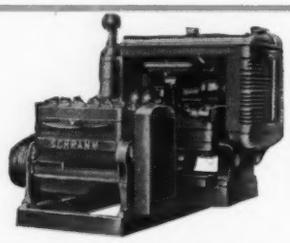
DIRECT DRIVE WITH STARTER AND RADIATOR

Both compressor and motor are mounted as a single unit on a substantial steel base with starter, radiator, and cooling unit.



DIESEL ENGINE DRIVE-IN LINE

Complete self-aligned, direct connected Diesel Engine Driven Compressor for semi-portable or stationary installation.



BELT DRIVE ON BASE WITH ENGINE

Schramm Engine Belt Drive on Base combinations are available for applications not reached by electric power service in mill, mine, and other industrial plants.

SCHRAMM INC.

COMPRESSOR SPECIALISTS
WEST CHESTER
PENNSYLVANIA

this technical assistant in all reasonable requirements.

This assistant is responsible for maintaining a record consisting of a sample copy of each blank form used by the distribution department in all its ramifications. Before February 2 yearly this assistant prepares an analysis of all major trouble as reported in the department's "Unusual Trouble Book" during the preceding year. This analysis is placed in the back of the above book. This staff member also performs such duties in connection with keeping the records of street and traffic lights as the company's instructions demand.

Each October this assistant is responsible for an inspection of all buildings and their contents, storage yards, substations and real estate outside these classifications which come under the department superintendent's jurisdiction. Such inspection includes examining the tags of all fire extinguishers to check monthly inspections. On or before January 1 and July 1 yearly he is responsible for checking the list of company telephone numbers, names, addresses and telephone numbers of all employees likely to be called outside regular hours. He is required to read all reports of trouble in the unusual trouble book and insure that department heads report these as specified. About April 1 and November 1 annually he considers the revision of the system diagram; changes it if necessary and issues revisions to replace all outstanding prints. He is responsible for keeping a so-called Master Diagram (and a small print in the telephone booth at the main service station) up to date at all times.

Annual Revisions

Another annual duty is considering the revision of all sets of written instructions used in the department; obtaining signatures showing that all such instructions and instructions not needing change have been read by employees holding them within one month of the time their signatures have been obtained. The technical assistant is also required to keep on file one copy of all obsolete instructions; a signature record of all keys issued; a record of each 13.2-kv. transformer diagram and name plate data, and is responsible for checking plant removal or abandoned records, distribution of energy generated and purchased reports, and other reports, let-

Can't Knock Out Permanently Insulated ROCKBESTOS A.V.C.

You may not be looking for trouble . . . but it's on its way if you are still operating overworked circuits that were nearing collapse before the war . . . and if you still have war-installed control, power and lighting wiring in hot spots that wasn't built to take the beating of high ambient temperatures and conductor-heating overloads.

Why take chances if that's your situation? Check up on the trouble-spots and plan to eliminate future production tie-ups, shut downs, and expensive emergency maintenance by re-wiring with Rockbestos A.V.C. Power Cable, Motor Lead Cable, Control Cable and Boiler Room Wire. Their *impregnated asbestos* insulation and heavy *asbestos* braid takes operating temperatures up to 230° F., the heat of overloads, and vibration because it retains flexibility and won't bake brittle or crack. It won't bloom or rot when exposed to oil, grease or corrosive fumes . . . it won't burn because asbestos is fireproof . . . and it can be installed in conduit because specially compounded impregnants give it high moisture resistance.

Don't delay necessary wire-failure prevention . . . investigate your needs for the Rockbestos-designed National Electrical Code types illustrated and others in our line of 125 different standard wires, cables and cords. Write or phone for recommendations to the nearest district office or:

ROCKBESTOS PRODUCTS CORPORATION
118 Nicoll St., New Haven 4, Conn.

125 different wires, cables and cords developed for severe operating conditions by Rockbestos.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK BUFFALO CLEVELAND CHICAGO PITTSBURGH ST. LOUIS
LOS ANGELES SAN FRANCISCO SEATTLE PORTLAND, ORE.

INVEST IN U. S. VICTORY BONDS

FOR POWER CIRCUITS

ROCKBESTOS A.V.C. 600 VOLT POWER CABLE (Nat. Elec. Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 AWG to 1,000,000 CM insulated with two walls of impregnated felted asbestos, varnished cambric and asbestos braid. Other constructions for service voltages to 5000.

You can use Rockbestos A.V.C. Power Cable for hot-spot wiring, in conduit or open, around boiler rooms, steam lines, furnaces, etc., and for power leads or heat-exposed electrical equipment as it withstands high temperatures and has ample moisture resistance. Use similarly insulated Rockbestos A.V.C. Motor Lead Cable for motor leads and coil connections.

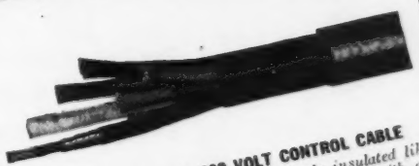
FOR LIGHTING CIRCUITS

ROCKBESTOS A.V.C. 600 VOLT BOILER ROOM WIRE (Nat. Elec. Code, Type AVA—max. operating temp. 110°C.)

Sizes No. 18 to 8 AWG insulated with varnished cambric, impregnated felted asbestos and asbestos braid. Sizes 6 to 4/0 have another wall of impregnated asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.

FOR CONTROL CIRCUITS



ROCKBESTOS A.V.C. 600 VOLT CONTROL CABLE

In one to 19 conductors with individuals insulated like Power Cable, cotton braid covered, and cabled with an asbestos braid overall. Standard strandings AWG No. 12—19/#25 and No. 9—19/#22. Other strandings on order.

Designed for use in equipment requiring a multi-conductor control cable capable of withstanding high temperatures, this cable is widely used in the control systems of electric cranes and other equipment used in steel mills. The insulation is unaffected by heat, corrosive fumes, oil or grease and has ample moisture resistance.

ANOTHER NEW ROCKBESTOS HIGH TEMPERATURE CONSTRUCTION!

War-developed Rockbestos High-Temperature Wire *— with a maximum operating temperature of 400° F.* — designed for jet propelled plane applications and circuits to hot-wing de-icers, fire detectors and extinguishers, and air conditioning and heating units where baking temperatures destroy ordinary insulation. Under continuous operation at rated temperature it retains its original dielectric strength and inherent resistance to heat and flame, and *progressively improves* in its resistance to moisture and abrasion. It is now available for these and other severe applications. Write for complete information and samples.

USE G-E PYREX PLUG FUSES to Protect Branch Circuits

3-20 Amp., 125-volts

These high quality plug fuses are ideal for new installations and replacements of all kinds. They are sturdy and built to give lasting protection.

The Pyrex Top—This top is one piece and heat resistant. Has insulated grip for easy handling. Also has magnifying lens window which aids in reading ratings.

The Base—The cold-molded base is designed to fit into the Pyrex top so that there is no chance of turning and damaging link. The arc of the blowing strip is ruptured in the well of this base.

The Shell—The shell holding the Pyrex top and the cold-molded base together is made of copper and plated with a non-oxidizing metal coating.

The Fuse Link—This high quality zinc link is attached at one end to the contact rivet in the base and at the other end it is soldered securely to the shell.

The Contact Rivet—This rivet carries the fuse rating. Thus amperage can be checked in two places—on the link and on the rivet. Note how the shell is staked to the base.

G-E Pyrex fuses are packed in handy fuse dispenser cartons—five fuses to a carton. The cartons can be tacked up near fuse panels. Fuses are taken from the bottom of the carton.

FOR FURTHER INFORMATION see the nearest G-E Merchandise Distributor or write to Section D162-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

GENERAL ELECTRIC

ters or estimates that may be handed him. He is required to keep all construction standards books satisfactorily up to date; for maintaining graphic curves of the number of employees in the distribution department, the payroll, contractors' bills and the total. This assistant is also available for handling unusual trouble and for circuit testing on occasion and, finally, is required to investigate all reports of overtime work which are turned in to him by the departmental secretary to see if overtime could have been avoided in any instance, calling attention of the matter to the superintendent in the event of its being found needless.

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Street Lighting Lamps, Their Characteristics

Data in tabular form are presented for six sizes of standard lamps for street lighting service. The compilation is a part of the distribution specifications for the West Penn Power Co. system.

Table 1

Series Lamps — Base-Up Burning Illuminating and Electrical Characteristics

Rated lumens	1,000	2,500	5,000	5,000	10,000	15,000
Rated candle power	100	250	500	500	1,000	1,500
Current, amperes	6.6	6.6	6.6	20.0	20.0	20.0
Lamp watts	64.5	151.8	281	279	524	746
Estimated load per lamp on series street lighting circuit, volt-amp.:						
Indoor dry-type transformer	72.5	176	315	350	670	923
Outdoor oil-filled transformer	74.4	182	334	378	690	1005
Base-up burning in fixture:						
Open type	Yes	Yes				
Luminaire type:						
Porcelain head			Yes			
Ornamental				Yes	Yes	Yes

Table 2

Multiple Lamps

Rated candle power	100	250
Lamp volts	120	120
Lamp watts	92	189

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Safety Instructions on Pocket-Size Card

Safe working practices on "hot" primaries and instructions for working on "dead" equipment have been drafted by the safety and training de-

partments of the Niagara Hudson System and printed on a convenient sized card for distribution to all interested company personnel.

Sizing up the job, when to wear rubber gloves, when and how to cover secondaries and grounds, and when and how to cover primaries and street lighting circuits are the subjects explained on one side of the card. De-energizing, mark-up, marking the safe working areas and installing barriers are the subjects covered on the other side of the pocket-size card.

ENERGIZED PRIMARY WORK
FOLLOW THESE SAFE PRACTICES AND PROTECT YOUR LIFE

1.—**"SIZE UP" THE JOB.**
Look job over, decide on safest working and climbing position. Size it up with the idea—you may cut out, slip or fall.

2.—**WEAR RUBBER GLOVES.**
Roll test your gloves.
Put on before entering primary area. Wear them when handling parts that may become accidentally energized.

3.—**COVER SECONDARIES AND GROUNDS.**
Cover them when your head, arms, body, or legs could get across grounds and primary at same time. Cover nearest conductors first.

4.—**COVER PRIMARIES & STREET LIGHTING.**
Cover when you can reach such wires or parts and they are, or might become "hot".
Take a safe position.
Guard against electrical contacts due to spur cut outs, slips, or mental lapses.

Keep rubber gloves on All the time you are in the primary area.

WORK ON *DEAD EQUIPMENT

1.—**DE-ENERGIZE—"KILL IT".**
Check Operating Diagrams.
Watch for "back feeds".
Be sure you have disconnected all power sources.

2.—**MARKUP.**
Test.
Ground.
If you are working it "Dead", be sure it is "Dead".

3.—**MARK THE SAFE WORKING AREA.**
Use flags, signs, tape and if needed, lanterns, flares, flood lights.
Before starting or resuming work Stop — Look — Think—is this the dead line or equipment.

4.—**INSTALL BARRIERS.**
Install when clearance to exposed live equipment is inadequate.
On the short job, "Don't Skimp".

*Refers to lines or equipment normally operated at voltages above 300 volts.

SEVEN OF EVERY TEN FATAL ACCIDENTS IN THE ELECTRICAL POWER INDUSTRY ARE DUE TO ELECTRIC SHOCK OR BURN.
NIAGARA HUDSON

SAFETY instructions on a 2½-in. by 4-in. reminder card covering energized primary and "dead" equipment work

- but it meant a $450,000 FIRE LOSS!

Put yourself in the place of the owners of this plant. Three of your buildings completely destroyed, with a fire loss of $450,000—all because your *fire protection did not protect.*

Not a pleasant situation—

But there is another side to the fire-protection picture. We call it the "Automatic" Sprinkler side. Long years ago "Automatic" Sprinkler established a course of action from which it has never deviated *—to produce fire protection systems and devices that answer the need for complete and adequate protection, no matter what the fire hazard.*

This policy has paid handsome dividends to users of "Automatic" Sprinkler equipment. It will continue to do so. For singleness of purpose, coupled with intelligent and persistent research, has resulted in *fire protection that really protects.*

"Automatic" engineers are well qualified to help solve your fire hazard problems. Write us today.

A famous member of the "Automatic" Sprinkler Family. Provides adequate protection from quench tank, transformer, oil line and other fires of flammable liquid origin.

"Automatic" Sprinkler

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA

YOUNGSTOWN, OHIO . . . . . , OFFICES IN 36 CITIES

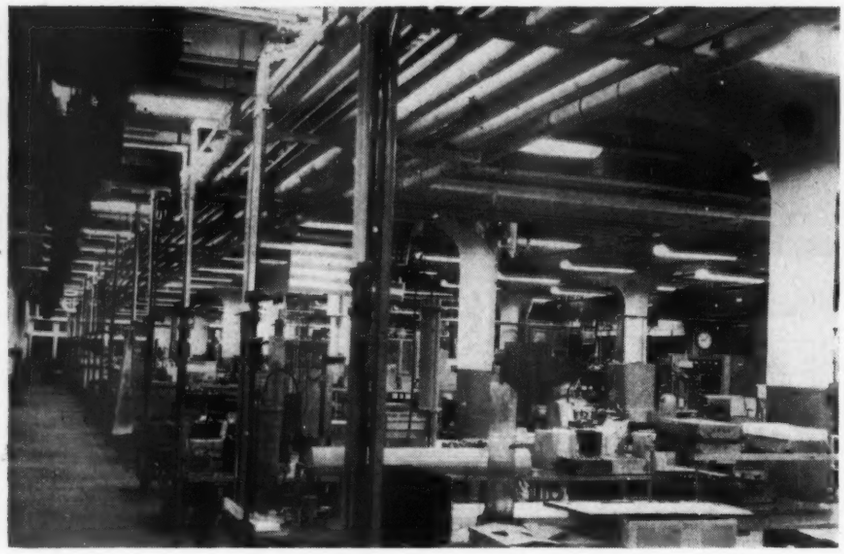
"Automatic" Sprinkler manufactures and installs a complete line of fire protection devices and systems for all types of fire hazards. Listed by Underwriters' Laboratories, Inc., and approved by Factory Mutual Laboratories.

LOAD BUILDING

Commercial
Industrial

Residential
Rural

Overhead Pipes No Barrier to Lighting



LIGHTING UNITS do not have to be placed below overhead pipes

Because the fluorescent tube is a line, not a point, source of light, the problem of interference by pipe or other overhead structures in industrial installations becomes less troublesome. With incandescent lighting, it is frequently necessary to install the units below such obstructions, thus increasing wiring cost and introducing special considerations into the illumination design. But with fluorescent lighting the problem of interference is mitigated, is less troublesome, because it is not always necessary to drop the lighting units below the obstruction. They often can be set above it at the same mounting height as the others in the area. The accompanying picture of a production area of the Westinghouse Lamp Division, Bloomfield, N. J., shows that fluorescent units can be installed above a considerable collection of overhead pipes without any observable reduction in lighting effectiveness below.

• • •

Post-War Home Service Building

ERNA FISHER
Director, Home Service Division, Hartford Electric Light Co.

Utility home service activities have made many new friends and contacts which will pay large dividends in peace time. With the curtailment of outside repair and meter reading during hostilities, home service employees' responsibilities and duties increased greatly. Hartford's meters are read quarterly. Our work in the fields of nutrition, cooperating with the Red Cross, city and state organizations, in civic groups such as war councils, war gardens, rolling kitchens, and canteen service, on food problems, in home economics and with women's clubs has helped public relations and aided important movements behind the lines. Through functioning of home service the company has been given entree into groups it had never before reached. Our representatives were able to advertise their own department directly to important community people who never knew of their existence before.

Post-war home service personnel must be increased if we are going to retain contacts and activities of the wartime period. More people will be needed to demonstrate the new equipment which will be purchased. Such departments must be a far cry, however, from the old time cooking schools and appliance demonstrations. Obscurity must no longer be characteristic of home service in company set-ups. Proper records of activities must be kept and reports made to the proper people, in order that the value of this work may be known. Post-war home service departments should have a place in the utility's public relations programs, advertising plans and radio work. The personnel should include an interior decorator who through lighting will take that story into the home, and a fabrics specialist who will carry the laundry and sewing machine story into the residence. Perhaps an architect may be required to take the kitchen planning story to the home maker, and home economists to carry the latest news about the range, freezer, cleaning equipment and refrigerator to the housewife. The home service department may possess employees in whom knowledge of these subjects is combined, and it befalls the director to develop her department personnel to meet the community's needs, discussing these with her superior on the basis of records to back up her recommendations.

Departmental Set-up

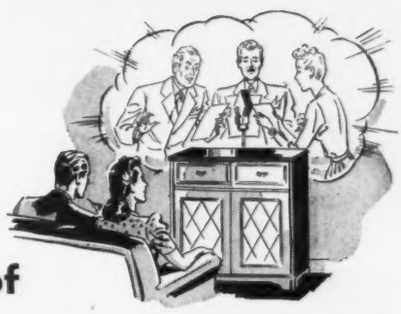
It would be my thought to house all the personnel of the entire domestic department of a utility under one roof if possible, to facilitate the customer's business. In connection with a home service auditorium, model kitchens, laundries, living room and bedroom layouts for demonstrating lighting would be of great value. An attractive platform with a test and preparation kitchen at the rear, with ample storage space, is essential. Each home service employee should have a desk for her records, company and personal belongings. The ideal director's office would be a simple and attractive living room where customers and employees could come in and sit down to discuss problems in comfort,

Frigidaire is on the Air

with a brilliant new RADIO SHOW

Top Movie Stars... Hit Shows of Hollywood!

World-famous movie stars... outstanding movies of our day—millions of families will hear them, and at the same time hear powerful, convincing selling messages on Frigidaire appliances in this...



Half-hour Program of

DRAMATIC ENTERTAINMENT

Every Week—Full CBS Network
147 Stations — Coast-to-Coast

Starting Sunday, January 6
2:30 p. m., E. S. T.

The Greatest Advertising Program in Frigidaire History, with this Outstanding New Radio Show ... Continued Heavy Advertising in ...

WOMEN'S MAGAZINES • HOME SERVICE MAGAZINES • NATIONAL WEEKLIES • FARM, SMALL-TOWN MAGAZINES • NEWSPAPERS HOME ECONOMICS MAGAZINES • COMMERCIAL TRADE MAGAZINES. *Plus* DEALER HELPS FOR NEWSPAPER AND RADIO ADVERTISING DIRECT MAIL • MOVIES • BOOKLETS • POINT-OF-SALE ADVERTISING

It all adds up to a tremendous advertising program to build still greater preference for Frigidaire, announce new Frigidaire products, tell all types of homemakers, in all parts of the country, why they will... *Be twice as sure with two great names...*

FRIGIDAIRE and GENERAL MOTORS

FRIGIDAIRE
Division of
GENERAL MOTORS
DAYTON 1, OHIO LEASIDE 12, ONTARIO

REFRIGERATORS • RANGES • WATER HEATERS
KITCHEN CABINETS • HOME FREEZERS • ICE CREAM CABINETS
COMMERCIAL REFRIGERATION • AIR CONDITIONERS
BEVERAGE, MILK, AND WATER COOLERS

privacy and quiet. A well ventilated, adequate and attractively decorated auditorium in the company's main office building or domestic section is essential to increase floor traffic and get people used to coming to the electric company and also to provide a meeting place available to outside club groups. If a radio program is sponsored by the utility, home service should have a definite part in it, as much useful and pertinent information can be better carried to the home by a woman employee. Hartford Electric Light's 26-week radio program from 6:30 to 7 on Sunday nights relative to the post-war home (previously described in ELECTRICAL WORLD) was very successful, and is planned to be resumed this fall. As a follow-up a "Home Planners' Institute" was conducted, consisting of four evening meetings on the post-war home, the attendance averaging 300.

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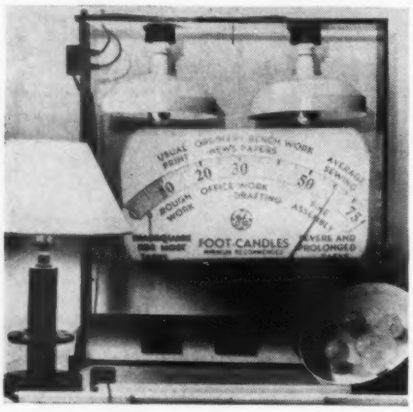
Factors of Lighting Demonstrated

FRED SCHROEDER
Monongahela Power Co., Fairmont, W. Va.



DEMONSTRATOR used in explaining technicalities of lighting

In conjunction with showings to women's clubs, PTA and other groups of the Westinghouse technicolor movie, "The Magic Touch," the Monongahela Power Co. uses the demonstrator here pictured to explain some technicalities of lighting. The scale framed in the demonstrator is from a projection light meter. The two identical reflectors at the top contain lamps of equal wattage but of different colors to show the effect of color on light output. The reflector at lower right contains one 100-watt bulb surrounded by four 25-watt, to indicate lamp efficiency, more light from the one than from the four others together. The reading lamp is used to demonstrate light distribution. Across the bottom of the frame are several receptacles for connection of different appliances to show the effect on light of voltage drop. Several types of fluorescent tubes complete the demonstrator kit.

•

Shoe Grease Electric Cooker Developed

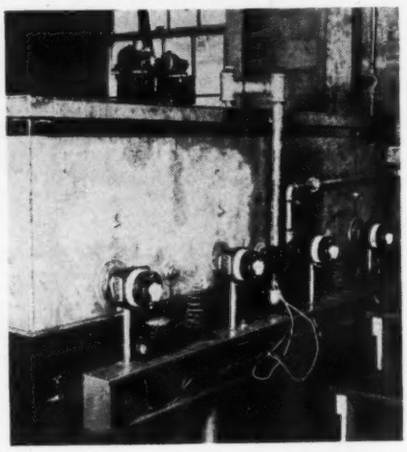
MARK M. CLAYTON
Bonneville Power Administration, Portland, Ore.

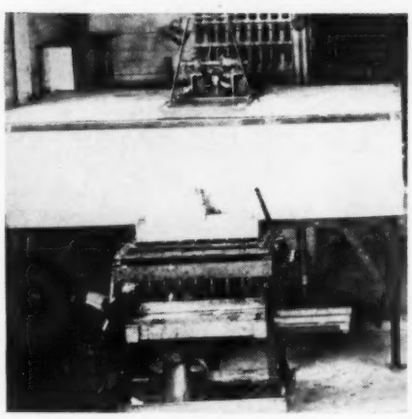
An oil-fired boiler for cooking shoe grease has finally given way to the electrically operated equipment illustrated at the plant of the Hubers Shoe Grease Co. of McMinnville, Ore. This company has for many years enjoyed a modest but constantly expanding business in the manufacture of shoe greases and oils. Originally the grease was cooked on a wood-burning kitchen stove and sold to the loggers of the Pacific Northwest. The product must have been good, because a small factory was started using an oil-fired boiler as the source of heat. As time passed the market expanded to include the entire United States. Finally the growing business and the ravages of time made the small oil-fired boiler both inadequate and unsafe.

An electrically heated steam generator was considered. However, it was decided to eliminate the pressure vessel along with the fire hazard that accompanies all fuel-fired equipment. Investigation indicated that heating the mixture of waxes, oils and other ingredients directly with electric heating elements would not be practical. The wattage density of such equipment would have to be extremely low to prevent carbonization of the product. Such procedure would require special elements that could not be easily obtained for replacement in case of a burnout. An insulated vat having a liquid-tight false bottom was used, thus providing a space for an inert, heat-resisting liquid to act as a heat-exchanging medium.

"Dowtherm" was selected to fill this space and is heated by four three-heat 7.5-kw. standard Chromolux immersion heating elements. Three well spaced thermostats govern the temperature of the heat-exchanging liquid. An elevated expansion tank connected with the space below the false bottom permits expansion of the Dowtherm without materially increasing pressure on the equipment. Insulated hinged lids cover the vat during the cooking process and a motor-operated stirring device agitates the mixture, insuring a uniform product.

The grease is processed in 800-lb. batches and requires approximately 30 kw.-hr. per batch or 0.037 kw.-hr. per pound of product produced. This makes the per pound cost for electric power almost negligible. A time clock is provided that can be used to start cooking a batch of grease during the early morning hours before the regular crew arrives. During rush seasons this arrangement permits the production of one extra batch each day without employing additional help.





ELECTRIC shoe grease cooking vat (top) showing four three-heat, 7.5-kw. heating elements and thermostats in center with expansion tank above. Bottom: Overall view of cooker. Drive for stirring mechanism is shown on top of tank, packaging equipment below

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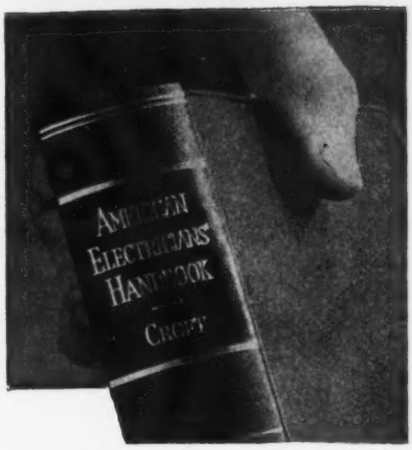
EVERY TYPE OF PRACTICAL ELECTRICAL JOB



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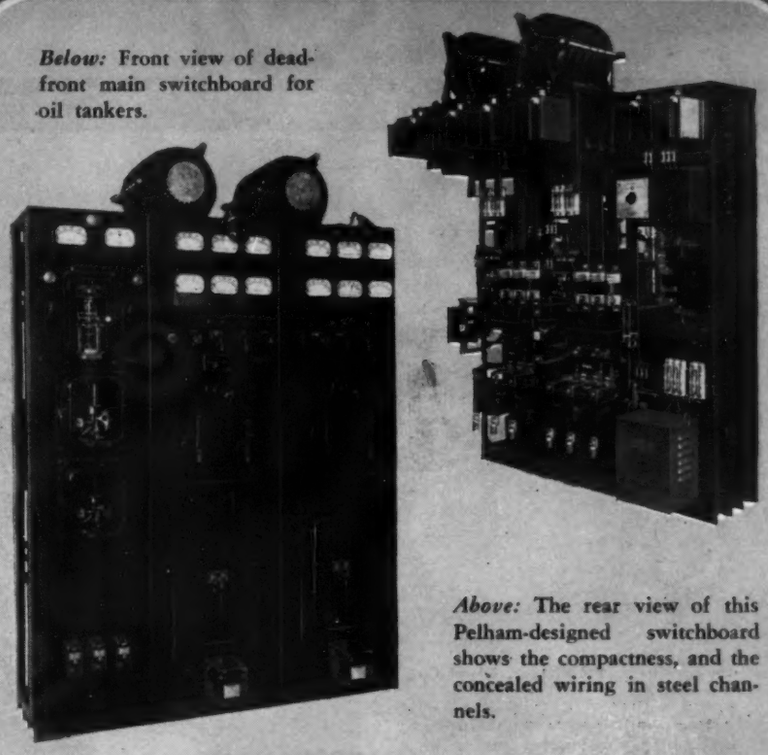


Below: Front view of dead-front main switchboard for oil tankers.

Above: The rear view of this Pelham-designed switchboard shows the compactness, and the concealed wiring in steel channels.

of Any Type of

SWITCHBOARD

TRY PELHAM FOR YOUR SWITCHBOARDS: No matter how difficult the design problems may be, our engineers have probably solved them . . . . Wide experience in designing every kind of switchboard and special panelboard . . . Built to the highest quality standards . . . And—*you can depend on our deliveries.*

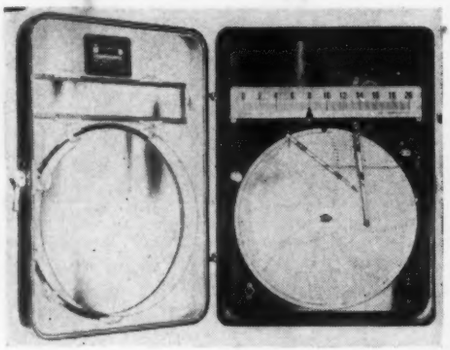
PELHAM ELECTRIC MANUFACTURING CORP., Erie, Penna.

SPECIALIZED DESIGN **Pelham** UNEXCELLED QUALITY

• SWITCH BOARDS • PANEL BOARDS • SWITCH GEAR AND ACCESSORIES

NEW EQUIPMENT

Controller



Proportional current input controller. **Bristol Co.**, Waterbury 91, Conn.

Electric type controller is a combination current input controller and recorder in a single case. The instrument provides on- and off-type control with proportioning control and is designed for use on electrically heated furnaces and ovens. A rotating cam interrupts the flow of current to the coils, the duration of which is determined by the departure of the controlled temperature from the control point.

•

Identification Labels

"Quick-Labels" for circuit identification: available in 200 different codes in 14 colors. **W. H. Brady Co.**, 2902 G. E. Lindwood Ave., Milwaukee 11, Wis.

Labels were developed to assist in marking or coding of wires, leads, circuits, conduits, relays, coils, terminal boards, fuse blocks, cables, etc. They are said to provide permanent identification, to stick without moistening and to be applicable to production or maintenance operations.

•

Motor Grease

Grease for ball and roller bearing motors and generators. **Westinghouse Electric Corp.**, 306 Fourth Ave., P. O. Box 1017, Pittsburgh 30, Pa.

Grease for lubricating horizontal or vertical supported machines operating between 13 and 176 deg. F. and up to 3,600 rpm. is available in an 8-oz. nasal type tube. The grease is said to be stable, resist oxidation, and not to cake or dry out for an indefinite period.

•

Fluorescent Starter

"Jack Rabbit" fluorescent starter: used with 40-watt instant starting lamps; measures 2¾ in. long, 2½ in. deep and 1 in. wide; white. **General Electric Co.**, 1285 Boston Ave., Bridgeport 2, Conn.

Unit is designed for split-second starting and is reported to have an automatic no-blink cutout feature. Used with conventional low-cost ballast, it is said to provide approximately 13 percent greater operating efficiency than high-voltage, instant-starting ballast system. It is designed to fit conventional starter sockets.

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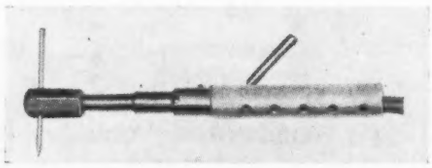
Electrode Holders



Air-cooled carbon electrode holders. **Tweco Products Co.**, Wichita 1, Kan.

New line of air-cooled carbon electrode holders is available in 150, 200, 300, and 500-amp. models. Among the features reported are "Hol-Grip" design and holder length and ventilation. The two smaller models are available with or without a special "Quick-Attack" whip cable for short duration jobs.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

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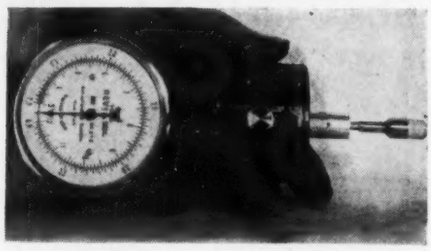
Tachometer



Four models of hand tachometers: range from 30 to 48,000 rpm. **George Scherr Co. Inc.**, 200 Lafayette St., New York 12, N. Y.

The four models are: model A from 30 to 12,000 rpm., B from 45 to 18,000 rpm., C from 60 to 24,000 rpm., and D from 120 to 48,000 rpm. It is stated that speeds may be clocked as close as one revolution per minute.

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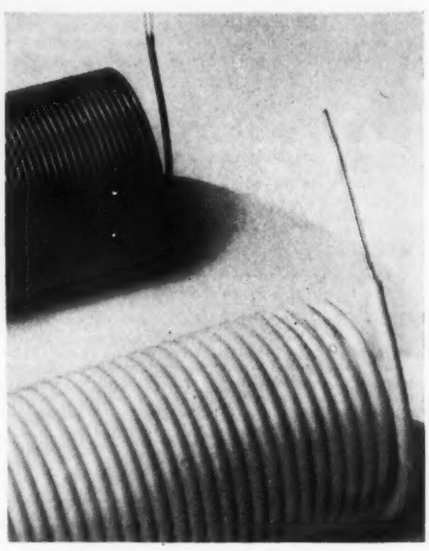
Wire



"Turbo-Therm" extruded insulated wire: sizes No. 24 to No. 30. **William Brand Co.**, 276 Fourth Ave., New York 10, N. Y.

The thermo-plastic insulated wire is made in fine stranded and solid conductor types and is reported as resistant to effects of oils, organic solvents, acids, alkalies, sunlight, ozone, and oxidation.

•

Motors

Type "V" series of universal motors: **Lear, Inc.**, 10 N. Ionica Ave., N. W. Grand Rapids, Mich.

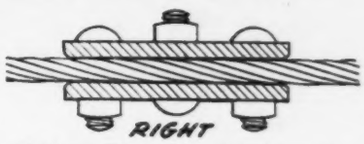
Motors are made in two types. The VC type are rated at 125 volts, a.c. or d.c., and have an output of 1/100 hp. at 7,500 rpm. The motors are non-reversing, with clockwise rotation at the fan end. With a ½-in. stack, the VC type has an overall length of $3\frac{31}{32}$ in., and is approximately 2½ in. in diameter. On the standard motor, the shaft at the fan end is fitted with a $\frac{15}{32}$-in. pulley, although special shafts or pinions are available. The VD

WHY?

DO HUBBARD STRAIGHT GROOVE GUY CLAMPS HOLD BEST?

1. **Because:** The **straight groove** eliminates the possibility of drawing a nut tight against an "arched" section which is out of contact with the strand.

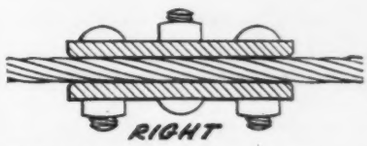
Clamping area reduced by warped section. Causes slippage at low strains.



Hubbard Clamps have full clamping area. Hold to breaking strength of most strands.

2. **Because:** The **straight groove** fits any and all twists, right or left hand and a variation in diameter without **creating** any high spots to **lessen clamping area.**

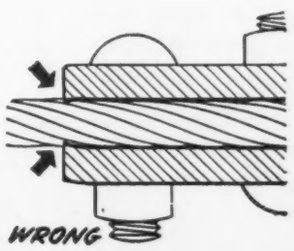
High spots in clamp reduce clamping area, cause slippage and injure strands.



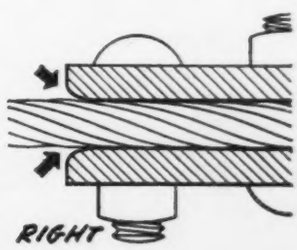
Hubbard Clamps fit snugly over any and all twists, right or left and variations of diameter.

3. **Because:** Bell-end grooves prevent injury to the strand.

4. **Because:** High carbon bolts prevent stripping or elongation. Heads are locked against turning while tightening—and the whole clamp is protected against corrosion by the best process commercially used — HUBBARD DOUBLE-DIP HOT GALVANIZING.



Sharp edge from sheared section injures and weakens the guy at end of clamp.



Rounded ends of Hubbard Clamp sections protect strand.

HUBBARD and COMPANY

Pittsburgh Oakland Calif Chicago

Long-Span Construction Cuts Rural Line Costs

Savings of $100 to $120 per mile have been reported where *Crapo* Steel Conductors have been used in long-span rural distribution lines. These savings will be an important consideration, in the rural power expansion program which lies ahead.

Crapo Steel Conductors are especially applicable to the tap and branch lines which make up a substantial part of the rural mileage yet to be built. These ferrous conductors, with their relatively low 60-cycle resistance and reactance, will carry the voltages and loads ordinarily imposed on typical rural extensions with a voltage drop well within prescribed limits.

I^2R losses on rural lines built of *Crapo* Steel Conductors are so small as to be negligible especially when compared with the potential overall savings. The high rugged strength of these conductors makes possible extra long spans, reduces the number of pole structures per mile, cuts material and labor costs, minimizes maintenance.

Complete Technical Information

Investigate the practical economy of *Crapo* Steel Conductors for your post-war rural program! Ask a representative of Graybar Electric Company, Inc., Distributor, or write direct for a copy of our Engineering Manual!

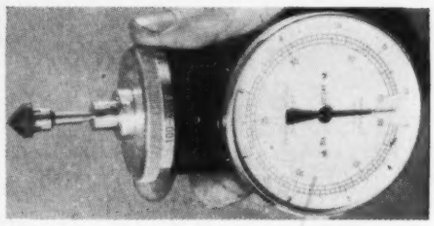
INDIANA STEEL & WIRE COMPANY
MUNCIE, INDIANA

Crapo HTC-130
STEEL CONDUCTORS

type motors are rated at same voltage and speed but have an output of 1/30 hp. These have a 1-in. stack, an overall length of 4¾ in. and are 3 in. in diameter. They are equipped with ¾-in. pulleys at the fan end and rotation is clockwise.

•

Tachometer



Type U hand tachometer: four models with ranges from 30 to 48,000 rpm. **Herman H. Sticht Co., Inc.**, 27 Park Place, New York, N. Y.

Instruments have 3-in. dial, are non-magnetic, of the centrifugal type, direct reading and damped to cut out oscillations. Ranges of the four models are 30 to 13,000, 45 to 18,000, 60 to 24,000 and 120 to 48,000 rpm. The overall range of each is divided into five special ranges with readability reported as close as one rpm. per division.

•

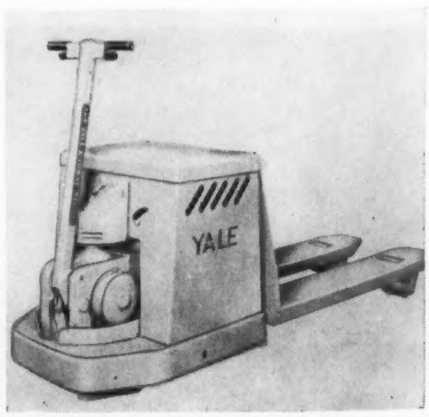
Circulator Fan

Heat circulator fan: 12, 16, 20 and 24-in. diameters; for 115-volt, 60-cycle supply. **Reynolds Electric Co.**, 2650 W. Congress St., Chicago 12, Ill.

Fan is of the ceiling mounting type for use in circulating air in hard-to-heat rooms such as churches, chapels, assembly room, taverns, rumpus rooms or other places which are infrequently heated. The air is blown upwards, traveling along the ceiling and down the walls.

•

Electric Trucks



"Worksaver" electric truck; platforms made in different lengths, from 36 in. to 72 in.; over-all width 31 in.; rear wheels in 6, 7 and 10 in. diameters. **Yale & Towne Mfg. Co.**, 4530 Tacony St., Philadelphia 24, Pa.

Trucks are of the "walk off" type with battery power for travel as well as for load lifting. Finger-tip pressure on dual cam controls, located immediately beneath the hand bar-grip, control the truck. Release of pressure returns drive to neutral and cuts off power. Two forward and reverse speeds are provided.

CATALOGS and BULLETINS

A monthly digest of recent manufacturers' literature compiled by Electrical World for your convenience in securing without obligation the most recent information on electrical and allied products.

CHECK ON COUPON BULLETINS DESIRED AND MAIL TO US. WE WILL FORWARD REQUESTS TO MANUFACTURERS.

1 TRUCKS: A 22-page catalog discusses this manufacturer's new line of trucks designed to incorporate improved engineering features. Numerous photographs are given. Technical details are shown in construction drawings. Also included are tables and specifications. Marmon-Herrington Co., Inc.

2 VERTICAL TURBINE PUMPS: Bulletin H-450-B33 presents typical applications of vertical turbine pumps, showing their adaptability to difficult surroundings. Worthington Pump & Machinery Corp.

3 PLASTIC INSULATION: Booklet entitled "Refractories and Insulations" outlines in detail miscellaneous uses of R & I STIC-TITE plastic insulation. Refractory and Insulation Corp.

4 A. C. ARC WELDING MACHINES: Complete description of a new and improved Wilson "Bumblebee" alternating current transformer arc welding machine is given in this 16-page illustrated booklet. Air Reduction Sales Co., Inc.

5 TRANSFORMERS: Catalog 451-GB, 112 pages, features transformers for sixteen fields of application including power circuit, mercury lamp, neon, signal, and street lighting. Descriptive information is given on ballasts, renewable and non-renewable fuses, fustats, plug fuses, and solenoids. Jefferson Electric Co.

6 GRAB BUCKET CRANES: Bulletin C9-1; 28 pages. Construction details and various industrial applications are illustrated in this bulletin describing grab bucket cranes. Harnischfeger Corp.

7 LAMPS: Booklet (A-4754) contains a complete line of photographic and projection lamps. This 20-page booklet gives practical information concerning photoflash, photoflood, color photography, motion picture production, spot light, fluorescent, photographic enlarger, projection and sound reproducer lamps. Westinghouse Electric Corp.

8 COLOR CODE CHART: A color code card and chart, designed to differentiate mica capacitors by a color code. Incorporates the RMA standards for the Six Dot Color and the Three Dot Color Code as well as the Army and Navy Standards. The basis of the code is the use of a distinct color for every number from zero to nine. Cornell-Dubilier Electric Corp.

9 CRYSTALS: A new crystal catalog features a wide variety of standard and special types of crystals. Principal types described are: octal types with cylindrical metal shield and standard eight pin base; three pin, two channel, aircraft type, etc. Aireon Mfg. Corp.

10 PORTABLE A-C TEST SETS: Bulletin GTEA-4477 contains data and descriptive information on the complete line of portable A-C test sets from 2,000 to 150,000 volts, with ratings up to 15 kva. In addition, it contains listings and a description of sphere gaps and current limiting resistance assemblies for use with A-C testing sets. General Electric Co.

11 EXTRACTION STEAM HEATERS: Bulletin No. 278 describes and illustrates extraction heaters of both horizontal and vertical types, for high, medium and low pressures. Cross-section diagrams graphically explain operation as well as construction of this equipment. The Criscom-Russell Co.

12 DEAERATION: Bulletin N-15, consisting of 20 pages and illustrated with charts and photographs, describes corrosion in general and the part which deaeration plays in checking it. Additional graphs cover the solubility of oxygen and carbon dioxide in water at various temperatures. Elliott Co.

13 STEAM TURBINES: Bulletin B6367 presents a pictorial description of this company's wartime experience in producing steam turbines for maritime use. This 12-page bulletin makes use of 52 photographs and drawings to illustrate the manufacturing processes used in placing these war-rushed steam turbines on a production line basis. Allis-Chalmers Mfg. Co.

14 SYNTHETIC RUBBER: Here is a 32-page primer style picture book entitled "Mechanical Molded Parts of Synthetic Rubber." It is designed as a guide to show engineering departments one way of developing and securing successful parts molded from synthetic rubber. Edition limited. Aero-Seal Rubber Products.

Circle numbers, sign and mail

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FOR MEN WHO WANT THE BEST

Every good workman appreciates high quality in the tools and equipment he uses. To a lineman, however, this regard for quality is more than admiration for fine craftsmanship. The lineman daily trusts his very life to his safety strap, belt and climbers—and under such conditions high quality is more than a matter of pride.

Good workmen know that there's no substitute for experience. It is the years of expert craftsmanship back of every piece of Klein equipment that make Klein belts and safety straps—Klein climbers and grips—Klein pliers and wrenches the first choice of linemen today as they have been "since 1857."

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This book on the care and safe use of tools will be sent on request.

Since 1857

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15 RESISTANCE WELDERS: Catalog No. SP-1 devotes 16 pages to principles of resistance welding including pictures and facts which illustrate the various types of welding equipment used. Each type is explained in detail. The Taylor-Winfield Corp.

16 GRAPHIC INSTRUMENTS: This compact little bulletin contains important data showing how graphic meters improve plant efficiency. A list of graphic meters are shown with appropriate illustrations indicating where each type is used. The Esterline-Angus Co., Inc.

17 PAINTS: Publication entitled "Paint Progress" describes in a number of articles how resin-oil emulsion paints differ from the conventional oil type flats, and tells, among other things, how manufacturers of those comparatively recent finishes get oil and water to mix. The New Jersey Zinc Co.

18 INSTRUMENTS: A catalog containing a wide variety of instruments and instrument supplies, includes watt meters, electrodynamometers, panel meters, light meters, megohmmeters, ohmmeters, pyrometers, tachometers, timers, wheatstone bridges, etc. These multi-range and multipurpose test instruments are shown with illustrations. Prices are also given. Electro-Tech Equipment Co.

19 VALVES: Bulletin E-150 describes in detail the features of these lever-operarted gate valves, including their quick action, straight-through flow, leak-tight seal and self-grinding of the sealing surfaces. Takedown illustrations emphasize the small number of parts that constitute these valves. Everlasting Valve Co.

20 PLASTICS: This 16-page bulletin discusses the electrical, mechanical, physical and chemical properties of a plastic material called "Synthane." Includes a list of electrical appliances and electrical power equipment made from this material. Synthane Corp.

21 THERMOCOUPLES: Bulletin S2-6 presents data on selection of thermocouples. It describes and lists prices and recommendations on the thermocouples, thermocouple wire, lead wire, heads, connectors, plug and socket assemblies, insulators, and protecting tubes. Wheelco Instruments Co.

22 LUBRICATING SYSTEMS: Folder presents basic facts covering the advantages of a centralized lubricating system. The Farval Corp.

23 FLOW METERS: Bulletins 82-A and 83-A give a detailed description of a rotameter which utilizes the basic advantages of the arch type flow meter for the measurement of large flows of liquids and gases. This equipment is made for direct reading and for remote reading in recording and recording-controlling types. Fischer & Porter Co.

24 LIQUID METER VALVES AND SLIDES: Information contained in this folder features the part played by Morganite as a component element in these liquid meter valves and slides. Morganite Brush Co., Inc.

25 ALUMINUM CONNECTORS: Bulletin No. 27 tells the story of aluminum connectors and reveals hitherto unpublished

technical and installation data on straight and angle aluminum lugs. In addition, it presents many suggested designs for unusual postwar requirements. The Thomas & Betts Co., Inc.

26 TRANSFORMERS: Bulletin C-300 features type KL and type CL transformers, illustrating the distinctive qualities of each. Cross-section drawings reveal inner parts. Moloney Electric Co.

27 FREQUENCY CONVERTERS: Bulletin No. 420 describes and illustrates induction frequency converters, outlining in great detail mechanical and construction features. Sets of 40 degree C or 50 degree C rise are available. Continental Electric Co., Inc.

28 SAFETY SWITCHES: This new catalog features service control and safety switches, multi-breakers and electrical specialties as well as a selected list of the more widely used motor control items. Many of the products listed in this catalog are of new design. Cutler-Hammer, Inc.

29 CONTAINERS: Briefly outlined in this new booklet is the graphic story of how containers used for conveying oil, gasoline, paints, milk and other miscellaneous liquids are actually put together. Illustrations show methods used in butt-welding seams. The Federal Machine & Welder Co.

30 ALUMINUM: A pamphlet entitled "Aluminum News-Letter" tells a story of the additional uses found for this material. Aluminum Co. of America.

31 SAFETY AND RELIEF VALVES: Catalog No. 45 and its supplement No. 45A describe a complete line of safety and relief valves, including many new valve designs and many improvements in old designs. A "ready-reference pictorial index chart" shows line drawings of all the basic valve types. A feature of this catalog is that each valve has a four-digit type-number which immediately indicates the design, the applications, and the connections of the valve. Farris Engineering Co.

32 MOTORS: A 4-page bulletin describes a motor developed for use in dusty locations and where there is excessive moisture. This motor is available in sizes from 2 hp. to 15 hp. Cut-away pictures of motors show construction features. Crocker-Wheeler Electric.

33 BATTERY CHARGERS: Bulletin 203 features battery chargers for materials handling systems. It includes types and descriptions of motor-generator sets used with battery chargers. Photographs illustrate construction features of complete battery-charger unit. Ratings of units range up to and above 25 kw. The Electric Products Co.

34 BELT JOINTS: This 4-page folder gives a step-by-step description of how to make rubber belts endless by the use of a special type belt joint. Seven advantages of this belt joint are listed, with supporting data. Illustrations show method of applying belt joint from start to finish. The B. F. Goodrich Co.

35 OIL RECONDITIONERS: Bulletin 100 contains 12 pages describing a special process of cleaning, dehydrating, degasifying, and stabilizing oils used for transformers, circuit breakers, oil-filled cable, tur-

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .

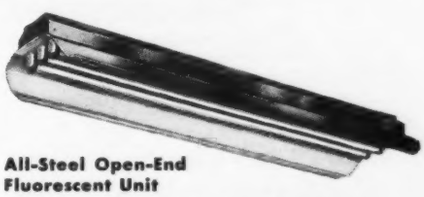
Does Your Plant Promote

Visual Skill?

There's a kind of skill that many manufacturing plants encourage to the highest degree and thereby increase production and profits. This is *visual skill* – the ability of the worker to "see faster", to set up his work, use his tools, read calibrations and make inspections more quickly and efficiently. There's one sure way to promote this – by the use of *Skilled Lighting!*

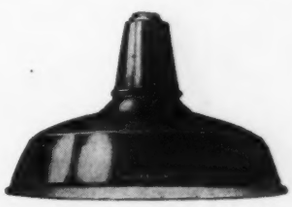
Wheeler has specialized in the study of visual skills and in designing and producing lighting equipment to meet all requirements – equipment that extracts maximum illumination from standard lamps. Wheeler's line of reflectors is made for long, efficient service – high grade, heavy duty materials with enduring vitreous enameling.

Learn how you can profit by increasing visual skills throughout your plant with Skilled Lighting. Write for Catalogs. **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channel with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.



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Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

Distributed Exclusively Through Electrical Wholesalers

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Made by Specialists in Lighting Equipment Since 1881

When it's Too HOT...Too HEAVY..

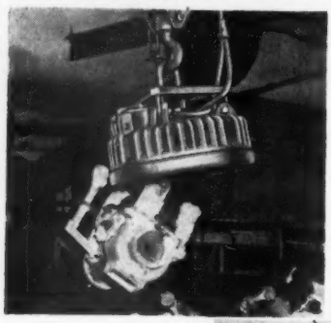
Too SLOW by Hand

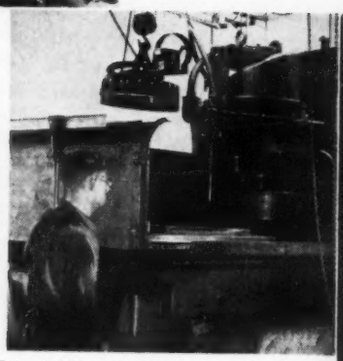
an EC&M Magnet
gives a LIFT wherever needed

10 CIRCULAR SIZES • A MAGNET FOR *EVERY* CRANE

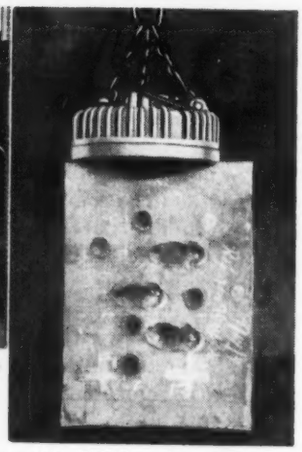
29-inch diameter Magnet receives 36-volt power directly from crane-truck.

Handling hot casting as soon as edges cool to become magnetic.





25-inch Magnet lifts heavy die-blanks on and off surface grinder.



29R size lifts 1200-lb. pierced armour plate on edge.

THESE are small magnets of 29-inch diameter and less, which are designed to do the odd jobs throughout industry. They handle hot castings from the shake-out floor and lift heavy material from floor to machine. Because of their low cost and medium weight, they can be effectively used on industrial crane-trucks to reach into corners, between machines, through narrow aisles—to cover the territory inaccessible to overhead cranes. New Bulletin 904 describes and illustrates these magnets at work. Write for your copy.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79th STREET • CLEVELAND 4, OHIO

bines, vacuum pumps, steel-mill bearings. Drawings illustrate how this process operates. Buckeye Laboratories Corp.

36 BALL AND ROLLER BEARINGS: A 270-page technical book entitled "Ball and Roller Bearing Engineering" can be used as a fundamental text on the subject of bearing applications to industry. The book, containing some 900 drawings and tables, begins with a technical description of common bearing types and continues through nine chapters of fundamental engineering studies. First copies of the book will be sent by this manufacturer to the heads of leading corporations. Late editions will be sold at cost by the company for students and others interested in bearing studies. SKF Industries.

37 PRESERVATIVES: New folder entitled "What to do about Termites and Lyctus Beetles" discusses the problem of decay and attack of termites and Lyctus beetles in lumber products, such as poles. A. D. Chapman & Co., Inc.

38 SELF-CONTAINED HYDRAULIC UNITS: Bulletin No. 302-U gives complete description and specifications of a new self-contained L-type hydraulic unit. Front, side and plan view drawings illustrate construction features of unit. It combines adaptability with unlimited versatility. Units range from 2, 5, 7½, 10, to 15 hp. John S. Barnes Co.

39 CENTRIFUGAL REFRIGERATION: Bulletin C-1100-B14 contains 24 pages showing a variety of applications for centrifugal refrigeration systems. Technical data are given covering sizes, types of refrigerants used, compressors, lubricating system, condensers, instruments and safety controls. Other technical data are complemented by photographs showing components and graphs indicating operating characteristics, load characteristics and dimensions. Worthington Pump & Machinery Corp.

40 FM EQUIPMENT: New 28-page bulletin discusses FM communication equipment, designed especially for use of public utilities, police departments, fire departments and other agencies authorized to operate in the 26-42 megacycle band. Each of the units illustrated represents a completely new post-war design. Bulletin contains data on basic systems, mobile installation, station installation, and station equipment. Radio Corp. of America.

41 "PRODUCTION" GUN: Bulletin No. 49 features the new type Y "Production" gun designed for hard, steady usage. Cut-away photographs show component parts of gun. Metallizing Engineering Co., Inc.

42 INSTRUMENTS: This new 28-page catalog illustrates and describes a line of standard and hermetically sealed electrical indicating instruments, including recent developments in the instrument field. Marion Electrical Instrument Co.

43 CARTRIDGE AND PLUG FUSES: A new 32-page catalog outlines in great detail construction of cartridge and plug fuses. Included is a chapter dealing with the operation of fuses. Technical description of short circuits, normal overloads, abnormal overloads, time current characteristics of fuses and interrupting capacity are also given. General Electric Co.

44 FLUORESCENT LAMPS: This 16-page booklet discusses in simple, understandable language how a fluorescent lamp is made and explains how it operates. Westinghouse Electric Corp.

45 SILICONES: A new 12-page catalog features the many uses of Silicones. It contains a comprehensive discussion of silicone properties. Dow-Corning Co.

46 FUSE CUTOUTS AND FUSE LINKS: New bulletin contains company's complete line of equipment—street lighting, fuse cutouts, pole line hardware, cable grips, lightning arresters, and transformers. Also contains an article entitled "The Story of Copper." Line Material Co.

47 LIGHTING AND CONTROL EQUIPMENT: Catalog No. 945 contains a concise treatment of engineered lighting and control equipment. Photographs and detail drawings amplify the text. Specifications and engineering details are also included. The equipment described includes stage lighting, exit and directional sign, indirect lighting, built-in lighting, fluorescent troffers and stage switchboards for schools, etc. Hub Electric Co.

48 CONVERSION FACTORS: Bulletin No. 4508 is an 8-page folder entitled "Conversion Factors and Formulas for Electrical Engineers." It contains over 600 conversion factors commonly used by electrical engineers as well as definitions of basic electrical units, prefixes, mensuration and temperature conversion factors. I-T-E Circuit Breaker Co.

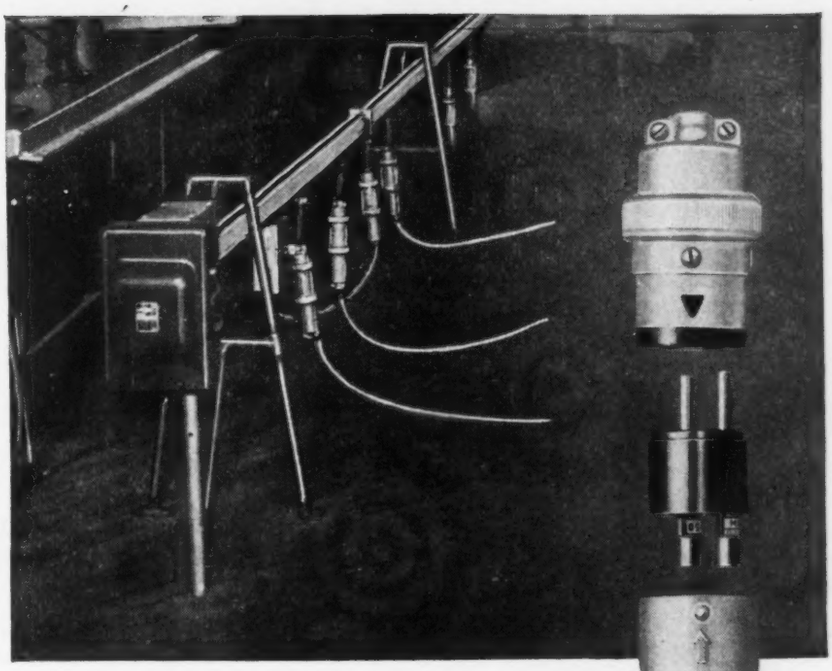
49 FIBRE CONDUIT: Catalog No. 49 contains information regarding methods used in laying fibre conduit. Technical details are given with illustrations and drawings showing actual installations. Tables, containing spacing data, are also shown. Difficult installations are discussed in detail with drawings. The Fibre Conduit Co.

50 DIESEL ENGINES: New 16-page color publication provides, through medium of word-and-picture stories, a representative cross-section of this manufacturer's engine experiences, gained and recorded under the conditions of everyday work in many fields. Caterpillar Tractor Co.

51 ARC WELDING ELECTRODES: A 32-page illustrated catalog is designed to guide electrode users in the selection of the right electrodes for any specific job. Data is supplied on the proper electrodes to be used for all types of work on a wide variety of base metals, describing the approved welding procedures for each electrode. Wilson Welder & Metals Co.

52 WELDING ACCESSORIES: Catalog No. 130 is a 12-page booklet illustrating and describing a complete line of accessories for all types of arc welding machines and operations. Types of equipment covered include electrode holders, graphite electrodes, welding cable, cable connectors, and cable lugs. Also listed are welding helmets, goggles, face shields, headgear, aprons, gloves, and sleeves. A section is devoted to an improved method of welding magnesium. Air Reduction Sales Co., Inc.

53 INSULATORS: This booklet entitled "A Story of Victor" devotes 24 pages to describing the step-by-step method of making porcelain insulators. Victor Insulators, Inc.



Battery of EVER-LOK connectors on FEEDRAIL in textile plant

EVER-LOK AUTOMATIC LOCKING RECEPTACLES, CONNECTORS & PLUGS

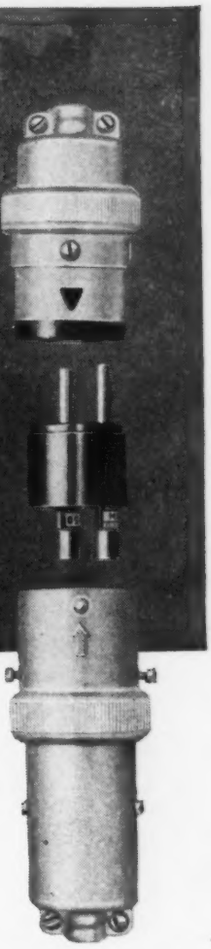
Where uninterrupted service is vital, Ever-Lok connectors insure against faulty contacts, vibration and accidental separation. They are the preferred standard for the connection of high cycle tools and portable equipment.

Locking is automatic and positive. Plugs cannot be inserted the wrong way. Steel clad, dust-proof, self-wiping and self-aligning contacts and positive grounding.

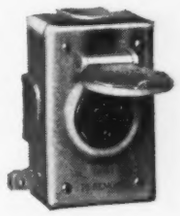
EVER-LOK is made in 2, 3, and 4 pole, 10 to 200 amperes and 2 to 11 pole for signal and control service.

Available in the form of receptacles and plugs for outlet and conduit boxes, surface and gang types, reverse and multiple circuit, weathertight and for cord connectors and also many special modifications not listed in the R. & S. catalog.

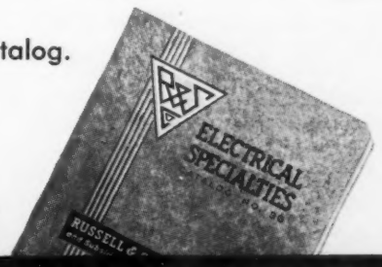
Ask for the 300 page R. & S. Catalog.



2-wire 3 pole EVER-LOK with midget or Busman fuses.



EVER-LOK receptacles, also available in gang type.



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EXPLOSION-PROOF, WATER-TIGHT, INDUSTRIAL LIGHTING FIXTURES AND EQUIPMENT. AUTOMATIC LOCKING "EVER LOK" CONNECTORS

125 BARCLAY STREET · NEW YORK 7, N. Y.

33

NEWS ABOUT PEOPLE

Ohio Edison Co. Elects S. Stites Vice-President

Samuel Stites, Youngstown division manager of Ohio Edison Co., has been elected vice-president of the company and Akron division manager to succeed the

S. Stites — *Blank & Stoller*

late Lon G. Tighe, and LaVerne I. Wells, assistant-secretary, has been elected secretary to succeed Charles H. Lahr, retired. Rufus Moses, for the past 19 years Sharon division manager of the Pennsylvania Power Co., has been appointed division manager of the Youngstown Division of Ohio Edison Co., succeeding Mr. Stites. Announcement was also made of the promotion of John I. Evans to general purchasing agent, to succeed Harry B. Lingeman, retired.

Mr. Stites became identified with the utility industry when he joined the Nashville Railway & Light Co. in 1916. After military service in World War I, he entered the student engineering course of General Electric Co. at Fort Wayne, Ind., and the following year was transferred to Schenectady. He then went to Nashville as a sales engineer for G.E. In 1927 Mr. Stites joined the Consumers Power Co. in Jackson, Mich., as power sales engineer, subsequently being transferred to the company's offices in Battle Creek. In 1928 he was moved to the Muskegon division in the same capacity. Attracting the attention of the executives of the Commonwealth & Southern Corp., of which Consumers Power Co. is a subsidiary, he advanced rapidly, and upon the death in 1936 of C. S. MacCalla, Youngstown division manager of Ohio Edison Co., Mr. Stites was appointed to succeed him.

Mr. Moses, the new Youngstown division manager, is no stranger to the community, having formerly resided in that city for eleven years. A native of Sharon, he went to work for the Shenango Valley Electric Light Co., a predecessor of Pennsylvania Power Co., in 1910 as storekeeper. All of his 35 years of business life have been spent with this utility company, its predecessors and affiliated companies. In 1915 he became superintendent of freight and passenger traffic for the Penn-Ohio system with offices in

R. Moses

Youngstown and in 1917 he was appointed assistant manager of railways for the entire system. Subsequently he joined the Pennsylvania-Ohio Power & Light Co. and during this connection was instrumental in organizing the Electrical League of Youngstown. It was in 1926 that he was named division manager of the Sharon Division of Pennsylvania Power.

Mr. Wells joined Northern Ohio Traction & Light Co. in 1919 as superintendent of stores. In 1924 he was elected assistant treasurer and in 1930, upon the formation of Ohio Edison, became assistant secretary and treasurer. Mr. Lahr, retiring secretary, is the oldest employee in point of service, having been with Ohio Edison Co. and its predecessors for more than 53 years.

•

Kapp Made Vice-President of Interstate Power Co.

M. L. Kapp, assistant to the president of Interstate Power Co., Dubuque, Iowa, was elected vice-president and assistant secretary at a recent meeting of the

M. L. Kapp

board of directors. In his new position, Mr. Kapp retains his responsibilities as assistant to the president in addition to his new duties.

Mr. Kapp, joined Interstate Power Co. in 1933 following association with the Michigan Public Service Co., Traverse City, where he was vice-president. As a young man he started work with the utility properties at Chandler, Okla. When the Oklahoma Natural Gas Co. later bought the properties at Chandler, he continued working with that company in various capacities until he left in 1936 to go with Michigan Public Service as assistant to the vice-president.

•

Grimm Gets Engineering Assignment in Florida

George A. Grimm has joined the staff of the Florida Power Corp., St. Petersburg, Fla., where he will be in charge of the transmission, distribution, engineering and production departments. C. B. McCartny will continue as superintendent of transmission and distribution and George E. Turner as superintendent of production.

Mr. Grimm has just returned from Japan, where he has held the rank of colonel in the U. S. Strategic Bomb Survey group. He had previously served as head of the power division in the Office

What 0.04% Phosphorus Does To Your Dezincification Problem

Plain Admiralty Metal has almost all the properties for successful condenser and heat exchanger tube service that are needed to meet many power plant and oil refinery applications . . . but it has one weakness — fair to poor resistance to dezincification.

Under certain conditions, its brass content is gradually replaced by a spongy, porous copper deposit, locally (plug type) or uniformly over the tube (layer type).

To overcome this problem . . . and still retain the high corrosion resistance of plain Admiralty . . . Scovill *Service in Metals* developed Phosphorized Admiralty*. This is the alloy that Scovill engineers are recommending for many types of power plant and oil refinery service where dezincification of plain Admiralty has been observed or anticipated.

Many Times Greater Life

By inhibiting dezincification, Phosphorized Admiralty offers much longer service life. This improvement is brought about by a very slight change in the alloy composition — the addition of approximately 0.04% phosphorus. There is no appreciable difference in the structure or mechanical properties between regular and Phosphorized Admiralty as shown by the photomicrographs and graph at the right. There is no impairment of the metallurgical, physical and otherwise excellent corrosion-resistant properties.

Experience of Scovill customers has shown that in cases where dezincification has been troublesome, a change to Phosphorized Admiralty extends service life.

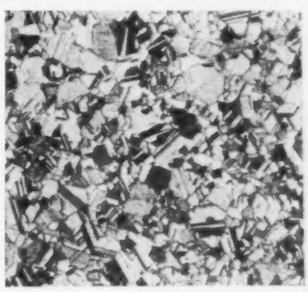
*"Phosphorized Admiralty Tubes" for condenser and heat exchanger service are covered by patent 2,224,095 and can be legally supplied only by Scovill Manufacturing Company, the owner of this patent.

Other Scovill Services

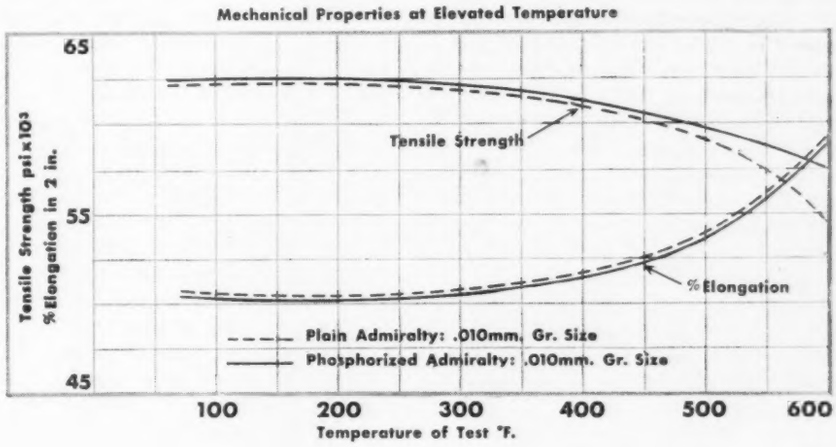
Service in Metals, which includes the development of new alloys to meet changing service conditions and also individual study of specific customers' problems, is one of three Scovill services, well-known throughout Industry. *Service in Men* provides specialized advice on tube problems, installation aids and "follow-up" services. *Service in Manuals* offers valuable literature on condenser and heat exchanger tubes. For a copy of our Condenser Tube Booklet, address Scovill Manufacturing Company, 24 Mill Street, Waterbury 91, Conn.

Top: Plain Admiralty.
Bottom: Phosphorized Admiralty.

75 x magnification.
Average grain size .035 min.



Mechanical Properties at Elevated Temperature



Plain Admiralty		Phosphorized Admiralty	
Copper	70.0 — 73.0	Copper	70.0 — 73.0
Tin	0.90 — 1.20	Tin	0.90 — 1.20
Lead	0.075 max.	Lead	0.075 max.
Iron	0.06	Iron	0.06
Phosphorus		Phosphorus	0.10 max.
Zinc	remainder	Zinc	remainder

Scovill
MANUFACTURING COMPANY
WATERBURY 91, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT . . . THREE SERVICES

Service in Manuals . . . Service in Metals . . . Service in Men

of War Utilities of WPB. In this position he headed utility survey parties that visited major power plants in France, England, Germany, India, Mexico and other countries before going on the Tokyo assignment.

A native of Illinois and a graduate of the University of Wisconsin, Mr. Grimm was connected with the Commonwealth Edison Co. in Chicago for a few years following graduation from college, but for the period from 1928 to the time he joined WPB, he was with the Indiana Service Corp. in an executive capacity.

•

RCA Victor Appoints Five New Vice-Presidents

Promotion of five RCA Victor executives to vice-presidencies has recently been announced. The new vice-presidents are: Meade Brunet, vice-president in charge of the engineering products department; J. B. Elliott, vice-president in charge of the home instruments department; J. H. McConnell, vice-president and general attorney of RCA Victor; J. W. Murray, vice-president in charge of the RCA Victor record department, and L. W. Teegarden, vice-president in charge of the RCA tube department.

The new vice-presidents, in addition to the other top administrative executives, report to the operating vice-president of RCA Victor, J. G. Wilson. Each of the new officers was formerly general manager of the commercial activity which he now heads as vice-president.

Reorganization of all of the RCA Victor Division's activities was recently completed for more efficient operation in preparation for full peacetime production, Frank M. Folsom, executive vice-president, stated. Under this realignment, the head of each commercial activity is directly responsible for all activities, including engineering, manufacturing, purchasing and selling.

•

► J. R. PERSHALL, director of advertising for the Public Service Co. of Northern Illinois, Chicago, resigned recently to form an organization under his own name to enter the general advertising field Jan. 1, 1946. Mr. Pershall has been associated with the utility for 23 years. WILLIAM E. PIERCE, assistant director of advertising, has been named manager of the company's advertising department.

► ARTHUR J. ROBERTS, who has been on the staff of the Canso, Nova Scotia, power plant since it was established 31 years ago, has retired. Mr. Roberts has served as superintendent of the plant for the past 28 years.

C. J. Hendon of Atlanta Made G.E. Vice-President

Claude J. Hendon, of Atlanta, Ga., has been elected a commercial vice-president of the General Electric Co. Mr. Hendon is succeeding E. H. Ginn, commercial vice-president, who is retiring after more than 44 years' service with the company,

C. J. Hendon

but will remain in an advisory capacity until July 1, 1946. Mr. Hendon also becomes a member of the President's staff, reporting to Vice-President E. O. Shreve.

A. L. Jones of Denver, commercial vice-president, is also retiring under the company's pension plan after more than 41 years' service, and the Rocky Mountain district, of which he was in charge, has been divided, with responsibilities resting with three other commercial vice-presidents. W. B. Clayton, with headquarters in Dallas, will become responsible for Denver and the immediate territory; R. M. Alvord, of San Francisco, for Salt Lake City and the immediate territory, and A. S. Moody, of Portland, Ore., for Butte, Mont., and territory westward.

Mr. Hendon has been associated with General Electric since 1927, when he entered the employ of the Edison General Electric Appliance Co. in Atlanta. He then was transferred to Chicago and, after serving in various sales capacities, in 1944 he was named district manager of the electronics department for the Southeast. After an assignment in Schenectady he was named assistant to Mr. Ginn last October.

•

► HAROLD P. LITCHFIELD has been appointed assistant general sales manager of the Graybar Electric Co. Mr. Litchfield has been associated with the organization for 30 years. In his new position he will supervise all sales contacts with the General Electric Co., including its lamp division, and have charge of Graybar sales in lighting, lamps, power apparatus, marine and signaling. E. F. MURPHY will take over Mr. Litchfield's duties on national accounts, reporting to G. F. Hessler, vice-president. He will make his headquarters in the executive offices and continue the activities he formerly carried on as eastern commercial sales manager in addition to his new national accounts assignment. Mr. Murphy has completed more than 25 years of service with the organization.

•

New Appointments Made by Westinghouse Corp.

Announcement has been made by the Westinghouse Electric Corp. of several new engineering assignments.

E. R. Nary has been made assistant to Vice-President Walter Evans with broad responsibilities for operations of the industrial electronics and X-ray divisions at Baltimore, Md., and the home radio division at Sunbury, Pa. A veteran of more than 30 years' service with Westinghouse, Mr. Nary takes over his new duties after three years as manager of manufacturing for Baltimore Divisions. As assistant to the vice-president, he will continue to maintain headquarters in Baltimore.

J. H. Cox has been appointed engineering manager for the Pacific Coast manufacturing and repair division headquartered at Emeryville, Calif. Mr. Cox joined Westinghouse in 1923 as a service engineer in New York, later being transferred to the general engineering department at the company's East Pittsburgh plant where he was engaged primarily in the lightning and research investigation of transmission lines and transformers. From 1930 until his recent transfer to Emeryville, he had been acting as manager of the mercury arc rectifier engineering section in the transportation and generator division.

Lyndon W. Clifford has been appointed electrical sales development councillor for the Hawaiian Electric Co., Ltd. Mr. Clifford has a background of 22 years' experience in electrical sales development with the Westinghouse Electric Corp.

Orland H. Yoxsimer has been named manager of the household refrigerator cabinet engineering division. Mr. Yoxsimer, who has been employed at Westinghouse since 1927, will be responsible for the co-ordination and development work on domestic refrigerator cabinets at the East Springfield and Mansfield, Ohio, plants. He will be stationed at the Mansfield plant where he has been section engineer of cabinet engineering since 1938.

Robert C. Dunson has been made product supervisor for the laundry equipment

department of the electric appliance division at Mansfield. Mr. Dunson has been with Westinghouse since 1932.

Arthur R. Dennington, Westinghouse Lamp Division engineer, has retired after 34 years of service. Since the inception of the Sterilamp, Mr. Dennington has been in charge of its application engineering. He has been located at Bloomfield, N. J., headquarters of the Lamp Division, for his entire Westinghouse career.

•

▶ E. C. WILSON, manager of the Selma District of the Alabama Power Co., has been named a member of the Dallas County Planning Commission.

▶ E. U. CONDON, formerly associate director of research, Westinghouse Electric Corp., East Pittsburgh, Pa., has been appointed a director of the National Bureau of Standards, Washington, D. C. A graduate of the University of California, Dr. Condon spent from 1928 to 1937 as associate professor of physics at Princeton University and while there wrote a number of papers and two books on quantum mechanics and the theory of atomic spectra. In 1937 he became affiliated with the research laboratories of the Westinghouse company as associate director.

▶ H. J. REICH, formerly special research associate, radio-research laboratory, Harvard University, Cambridge, Mass., has been appointed professor of electrical engineering, Yale University, New Haven, Conn. After serving on the staff at Cornell University, his Alma Mater, Dr. Reich became assistant professor of electrical engineering at the University of Illinois, Urbana, and later professor of electrical engineering. In January, 1944, he was granted a leave of absence to join the staff of the radio-research laboratory at Harvard University. He is the author of several textbooks and a number of technical papers covering electron tubes, tube circuits, and related subjects. Dr. Reich is past-chairman of the Urbana Section of the American Institute of Electrical Engineers and is also a senior member of the Institute of Radio Engineers and a member of the American Association for the Advancement of Science and of the Society for the Promotion of Engineering Education.

▶ L. C. SPOOR has been appointed director of sales for Eicor, Inc., Chicago. The addition of a complete line of newly designed fractional horsepower a.c. motors to the familiar dynamotors, d.c. motors and other rotary equipment will create greatly increased sales and promotional activities for which Mr. Spoor's experience is admirably suited. He was formerly in General Electric Co.'s small mo-

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AIRPLANE DIVISION-BUFFALO PLANTS
BUFFALO, N.Y.

September 12, 1945

Buell Engineering Co., Inc.
70 Pine Street
New York 5, New York

Gentlemen:

It is a pleasure to answer the recent inquiry from your Engineering Department checking upon the mechanical operation of the Buell Dust Recovery Systems installed in our three plants.

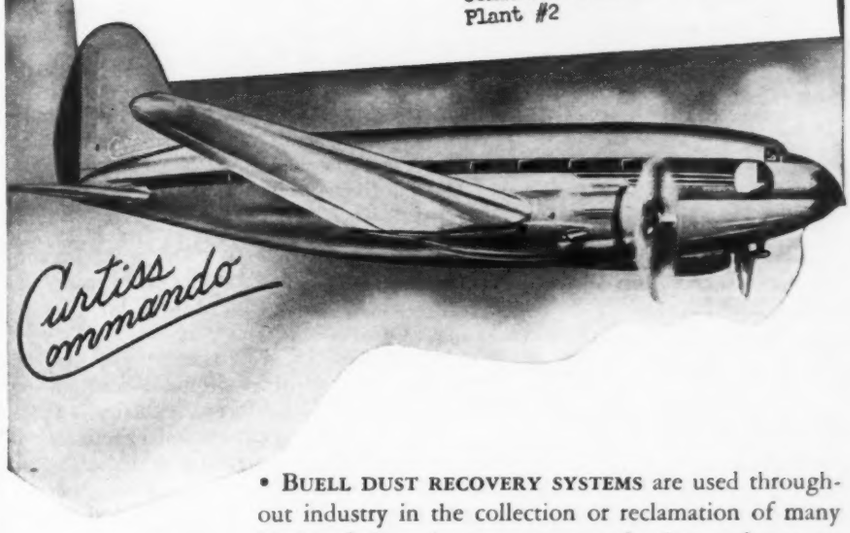
Buell Fly Ash Collectors have been in service on twelve (12) boilers since 1941, operating continuously.

Since the time of their installation, they have cost us nothing for maintenance or repair. Their collection efficiency has fully met our requirements, and they have accomplished in a highly satisfactory manner the job for which they were installed.

Yours very truly

Guy Maher

Guy Maher, Plant Engineer
CURTISS-WRIGHT CORPORATION
Plant #2



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Medical Electronics
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tor division in charge of sales policy and has been associated with the small motor business for more than 16 years. Mr. Spoor is chairman of the NEMA fractional motor subdivision.

▶ R. KARL HONAMAN has been appointed director of publication for the Bell Telephone Laboratories, Inc. Under his supervision are advertising, technical publications, information for the popular and technical press, the magazine *Bell Laboratories Record*, and other informational services. Graduating from Franklin and Marshall College in 1916, Mr. Honaman spent more than two years in Washington during World War I in studies relating to airplane engine design. In 1919 he joined the development and research group of American Telephone & Telegraph Co. and with that group transferred to Bell Telephone Laboratories in 1934, his work dealing with protection of telephone circuits. When, at the beginning of World War II, the Bell Telephone Laboratories undertook to train technicians for the Army and Navy on radar and related developments, he organized the School for War Training and was its director until May, 1945. Since then, he has been an assistant director of publication.

▶ C. R. BRAUN has been appointed supervisor of Allis-Chalmers Manufacturing Co.'s steam turbine department marine sales. In his new position, Mr. Braun will be responsible for long-range sales coverage of the expanded peacetime production of marine steam turbines. On joining Allis-Chalmers, he served in the engine and condenser department and in the general manufacturing department, later transferring to the steam turbine department.

▶ ARTHUR H. SMITH has been appointed by the Kerite Co. as railroad sales manager. Mr. Smith began his business career in 1912 with the Railroad Supply Co. and in 1930 became vice-president of the Railroad Material Co., an outgrowth of the former. During 1932 he was eastern railroad sales manager for the Youngstown Sheet & Tube Co. and one year later became associated with the Kerite Co. During World War II Mr. Smith served for three years in the U. S. Coast Guard Reserve (T) 3rd Naval District and was discharged from service after serving as flotilla commander.

▶ WILLIAM A. MARSHALL has been appointed vice-president of the Noma Electric Corp. Mr. Marshall will be in charge of manufacturing and production for all Noma plants and subsidiaries including Triumph Industries, Inc., of which he continues as vice-president and a director.

▶ J. M. WICHT, for more than thirteen years divisional manager of the laundry equipment division of the General Electric Co. at Bridgeport, Conn., has been appointed vice-president and manager of the Blackstone Corp., Jamestown, N. Y. From 1942 until the beginning of this year, Mr. Wicht was president of the American Washer and Ironer Manufacturers' Association.

▶ PHILIP L. WHITE, formerly superintendent of the electrical department in the Brattleboro division of the Central Vermont Public Service Corp., has been elected town manager at Brattleboro.

▶ MELVIN E. JOHNSON, manager of the Bellevue office of the Nebraska Power Co., has been appointed manager of the company's southern district to succeed W. H. Phelps.

▶ JOHN D. GORDON, formerly general sales manager of the Progressive Welder Co., Detroit, has been appointed general manager. P. D. DELEO has been named development engineer; I. A. CRAWFORD, research engineer and E. Y. BUNTING, machine design engineer. Mr. DeLeo was associated with the Carnegie Illinois Steel Co. for seven years and recently was with the Federal Machine & Welder Co. as design and development engineer. Mr. Crawford was recently with the Westinghouse Electric Corp. as manufacturing engineer in the headquarters manufacturing engineering department, specializing in resistance welding equipment, design and applications. Mr. Bunting was for a period of more than nine years designing and welding engineer at Federal Machine & Welder Co.

▶ E. E. BOHREN has been named general sales manager of the Sweeny Sound Engineering Co., Toledo, Ohio, builders of electrical sound recorders and public address systems. Mr. Bohren will be in charge of customer contacts, public relations and advertising. Prior to his new position, Mr. Bohren was, for the past eight years, plant promotion director for the Libby Glass Division of the Owens-Illinois Glass Co.

▶ PAUL S. ELLISON, director of advertising and sales promotion for Sylvania Electric Products Co., has been elected chairman of the Association of National Advertisers. An A. N. A. member for twenty years, Mr. Ellison has served on the association's board of directors for several years and is present chairman of their public relations committee.

▶ HERBERT L. ROSS, since 1941 superintendent of the Everett supercharger division of the General Electric Co., has been appointed general superintendent of the

West Lynn (Mass.) Works of that company, which he joined in 1924. For some time Mr. Ross was connected with the meter division at Lynn and was at one period in the time switch department. Studies of waste, spoilage and manufacturing methods have also occupied much of his attention.

OBITUARY

▶ LESLIE E. ROSS, vice-president and general superintendent of the Niagara Falls Power Co., died on December 22 in a Niagara Falls, N. Y., hospital after a week's illness. He was 60 years old. He had been associated with the power company and its predecessors for about 45 years. He started as a lineman's helper with the old Hydraulic Power & Manufacturing Co. In 1924, Mr. Ross was named operating superintendent of the Niagara Falls Power Co., becoming general superintendent 10 years later. In 1934 he was made general superintendent of generation and transmission for the Buffalo, Niagara & Eastern Power Corp., as well as general superintendent of the Niagara Falls Power Co. It was in 1941 that he was made a vice-president of Niagara Falls Power.

▶ FREDERICK D. JACKSON, associate professor of electrical engineering and university radio engineer at the University of New Hampshire, died at the Methodist Hospital in Philadelphia, Pa., on December 18 after a long illness. Professor Jackson was born on May 30, 1898 in Royersford, Pa. After receiving a B. S. from Pennsylvania State College in 1920, he was connected with the Western Electric Co. in New York and later with the radio engineering department of the General Electric Co. Before going to the University of New Hampshire in 1924, he was on the teaching staff at Cornell University. During the summers he had worked for the Philadelphia Electric Co., American Telephone & Telegraph Co. and New England Telephone & Telegraph Co. Professor Jackson was on leave of absence from the university for a year beginning in August, 1944, doing research work for the Bell Telephone Laboratories in New York.

▶ ROWLAND HAZARD, executive vice-president of the Bristol Company, Waterbury, Conn., since 1941, died in that city of a heart ailment on December 20 in his office. He was 64 years of age. Mr. Hazard was born in Peace Dale, R. I., and was graduated from Yale in 1903. He received his early experience with the Peace Dale Manufacturing Co. and the Semet-Solvay Co. and later was affiliated with the Peace Dale Manufacturing Co. and with Lee, Higginson & Co., investment bankers, and with the brokerage house of Tailer & Robinson.

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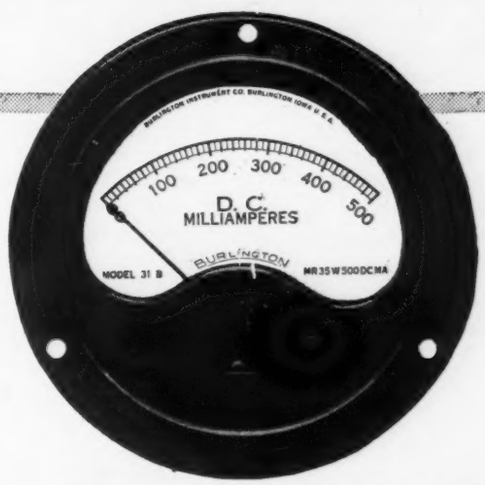

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MANUFACTURING MARKETS

Buckingham Co. Sold to New Interests

Sale of W. H. Buckingham Manufacturing Co., makers of linemen's supplies at Binghamton, N. Y., has been made to Walter E. Craw, who until recently was vice-president and comptroller of Stow Manufacturing Co., also of Binghamton.

The deal includes two plants—one in Travis Street and the other in State Street. More than 50 persons are employed in the combined operation.

The new ownership will operate under the name of Buckingham Manufacturing Co., with Mr. Craw as president and general manager. Plans call for continued manufacture of climbers, belts, safety straps, plier pouches, climber straps and pads, tool belts, linemen's knives, and plier handle grips for the electric power and telephone companies.

The Buckingham company was originated in 1913, since which time steady increases in business have led to three additions to manufacturing plant, the latest of which was made during the war.

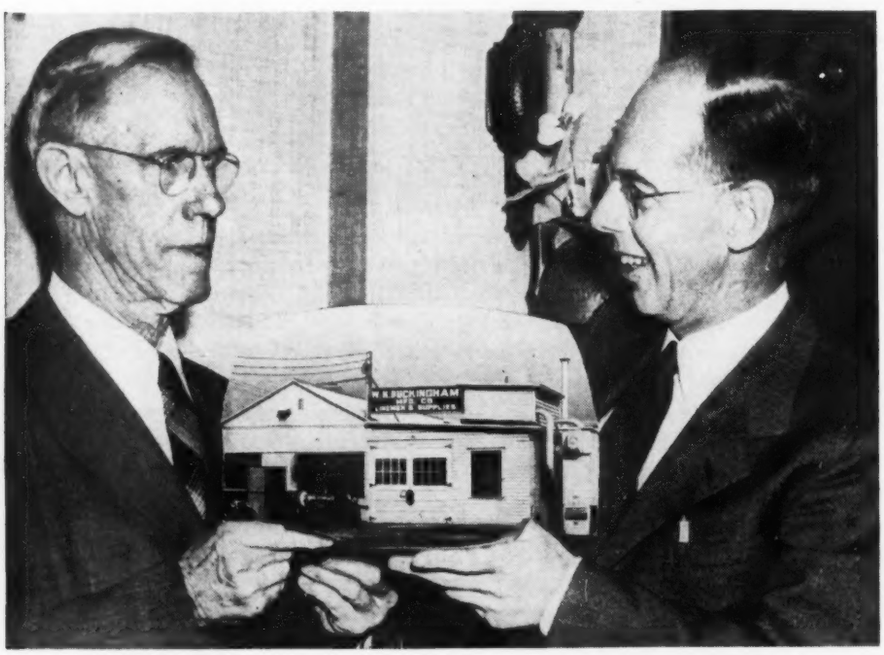
The only change in organization, announced to date, has been the appointment of A. L. Dickson, formerly associated with Stow Manufacturing Co., as office manager.

•

Allied Control Buys Miller Transformer Co.

Acquisition by Allied Control Co., Inc., New York, of the B. F. Miller Co. of Trenton, N. J., has been announced by E. H. Gillette, president of Allied Control. Organized in 1910, the Miller Company is manufacturer of all types of transformers, particularly those which require special developments or which have unusual applications. Allied Control manufactures relays and electronic devices.

Mr. Gillette indicated that a policy of research and development would be continued and that the facilities of the company would be enlarged and improved. B. F. Miller remains as executive vice-president and general manager.



OWNERSHIP CHANGES—Walter E. Craw, new president of Buckingham Mfg. Co., recently accepted a photograph of one of the company's three plants from W. H. Buckingham as a token of change in ownership of the company

Predict Peak Output of Power Equipment

A new all-time high in production of electric power plant equipment is expected in 1946, with utility companies anticipating that electrical energy requirements in 1947 will surpass wartime peak consumption, the National Industrial Conference Board has reported.

Three factors are prominent in this outlook, according to the Conference Board: (1) Anticipated expansion in electric production capacity; (2) heavy demand for industrial electric equipment that will consume a large part of this power increase and (3) prospects for extensions of service lines to agricultural areas in the next three years.

"Rapid expansion of electric power production for war purposes," the Conference Board said, "was accomplished with a relatively small addition to plant and equipment. Consumption jumped 73 percent while additions to plant and equipment amounted to only 26 percent. This situation followed the decision in 1942 to eliminate all but the most critically needed power plant construction, in order to meet the demands of war agencies. Drastic changes in distribution methods were necessary to avoid serious power shortages. Normal competitive methods were abandoned and replaced by a gigantic power pool.

"With a return to peacetime conditions, there is a need for an extensive expansion program. This is reflected in the current heavy burdens placed on operating capacities of electrical equipment plants. Customers are making active inquiries as to time of delivery of urgently needed equipment. In several lines, consumers will be served sooner than had been anticipated while in other lines deliveries will be delayed. Deliveries for maintenance and repair will be given first consideration.

"Prices will remain at current levels for the time being, although increased labor and overhead costs may subsequently force pressure for higher prices. Labor costs during the war increased as much as 35 percent in some cases."

•

G.E. Sells Fixture Business to Electro Manufacturing

Sale of G. E. Lamp Department's business in "RF" (rectified fluorescent) and Cooper Hewitt fixtures to the Electro Manufacturing Co., Chicago, has been announced by the G. E. Lamp Department's Nela Park headquarters, Cleveland, Ohio.

Disposal of this fixture business on the part of General Electric is in keeping

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10,000,000 STRONG RIGHT ARMS

Victory did *not* end the paper shortage. Need for waste paper is as great as ever.

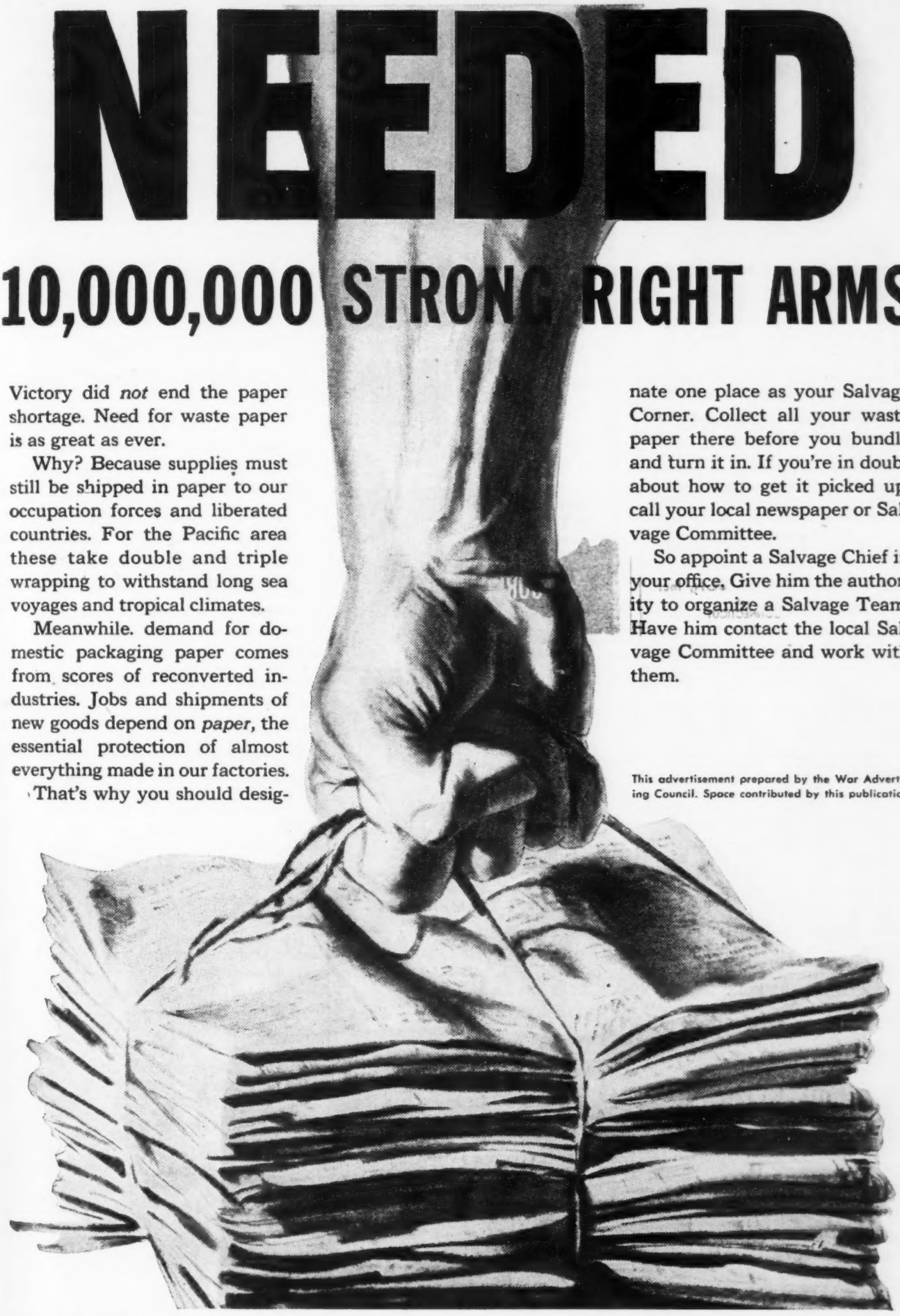
Why? Because supplies must still be shipped in paper to our occupation forces and liberated countries. For the Pacific area these take double and triple wrapping to withstand long sea voyages and tropical climates.

Meanwhile. demand for domestic packaging paper comes from scores of reconverted industries. Jobs and shipments of new goods depend on *paper*, the essential protection of almost everything made in our factories.

That's why you should designate one place as your Salvage Corner. Collect all your waste paper there before you bundle and turn it in. If you're in doubt about how to get it picked up, call your local newspaper or Salvage Committee.

So appoint a Salvage Chief in your office. Give him the authority to organize a Salvage Team. Have him contact the local Salvage Committee and work with them.

This advertisement prepared by the War Advertising Council. Space contributed by this publication.



This powerful pruner cuts closer, is stronger than any other similar tool on the market. Can be operated in close tangled growth; cutting easily and cleanly branches up to 1½" in diameter. No trouble with spring breakage.

Here is the only pruner with the famous Seymour Smith "Center Cut" construction; safety catch to lock blade closed; one piece tempered tool steel blade; reinforced hook; extra long life spring; ball bearing pulley; highest quality chain; unbreakable iron head.

Designed by experts for experts; demanded by public utility companies everywhere, it will pay you to write for literature and prices.

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My check ( ), money order ( ) is enclosed.

with the lamp department's policy not to engage in the manufacture of lighting equipment. Lamp Department of G. E. will continue to manufacture "RF" and Cooper Hewitt lamps.

Electro Manufacturing Co. has been in the lighting fixture business for the past fifteen years.

G. R. Clover, formerly Cooper Hewitt specialist and more recently sales representative for G. E. Michigan sales district, resigned his position with G. E. Co. December 1 to join Electro Manufacturing Co. in an executive capacity, to supervise and to assist in sales operations of the newly acquired business.

•

Rural Survey Report Made by Square D

Rural building and farm modernization is at the threshold of extraordinary progress through electrification and installation of many types of household appliances as well as farm machinery operated with electricity, according to a survey of activities throughout the United States reported recently at a meeting in Milwaukee, Wis., of more than 125 field engineers and representatives of Square D Company.

Square D estimates show that of America's approximately 6,000,000 farms, half are electrified to the extent of lighting, and of the remaining half, more than 90 percent have electric power lines within one quarter mile.

Basing their estimates of the activity ahead on the rapidity with which rural electrification is advancing, the field managers and engineers reported that with farmers today financially better able to satisfy their desires for modern equipment, factories making units are oversold already. It was pointed out that demand for electrical switches for the farm market have multiplied four times in the last seven months.

Square D branch managers from the more important agricultural areas of the nation said that farmers are preparing not only to completely modernize their farms but also to invest large sums in new buildings.

In the so-called working department of the farm, old buildings are being equipped with modern electrical machinery, water systems and other types of equipment to provide greater sanitation and ease of work. Electrification is made more necessary also by the trend toward consolidation of smaller farms which means the farmer must be able to do more work with less effort.

The spread in electrification, it was shown, is such that both central station companies and government agencies engaged in rural work are specifying heavier equipment because of the increased loads to be put on the lines by each

user, in comparison with original farm electrification which included little more than lighting.

•

Brooks Rotameter Company Organized

Stephen A. Brooks and seven associates, each with extensive experience in rotameter manufacture and application, have organized the Brooks Rotameter Co., a corporation capitalized at $100,000.

S. A. Brooks

A factory with 18,000 sq. ft. of floor space has been acquired at Lansdale, Pa., and manufacture has been started upon all types of rotameters for flow rate measurement control.

Mr. Brooks is a graduate chemical engineer with wide experience in chemical manufacturing and instrumentation. For the past six years he has been vice-president of Fischer & Porter Co. in charge of sales and advertising. The eight men founding this new company have an aggregate of 40 years' experience in rotameter engineering, an average of five years per man. The address of the company is Box B-5411, Lansdale, Pa.

Harry H. Long will be chief fluids engineer in charge of specifications and calibration. He will be assisted by James Anthony and Joseph Ducsik, who have had many years' experience in specifying and calibrating rotameters. Garbutt W. Aiman will be in charge of precision rotameter tube manufacture. Jack Bradley will be in charge of production and Lou Rosenblum will handle purchasing and accounting.

•

Moves Sales Offices

Proctor Electric Co. has announced the removal of its sales offices from 480 Lexington Ave. to the Daily News Building, 220 East 42d St., suite 2410, New York 17. The service department will continue at the Grand Central Palace, 480 Lexington Ave.

R.M.A. Head Reports on Rubber Status

A. L. Viles, President of the Rubber Manufacturers Association, on his return from London, where he served as a member of the American Delegation attending the recent International Study Group on Rubber, pointed out that American synthetic rubber is increasingly recognized as a basic world raw material that fills a postwar need of real proportions.

Mr. Viles stated that the Study Group had estimated that the uncertainties of the situation in the Far East made it probable that supplies of natural rubber in 1946 would be less than had been generally expected, and that continued high production of synthetic rubber would be necessary in order to meet the enormous pent-up demand for rubber products.

According to Mr. Viles, it is likely that total passenger car tire production in 1946 will be considerably more than double 1945 production. Anticipating a total consumption for all types of rubber in the United States alone of 900,000 tons in 1946, Mr. Viles forecast that a total of 600,000 tons of synthetic rubber would be consumed in the United States.

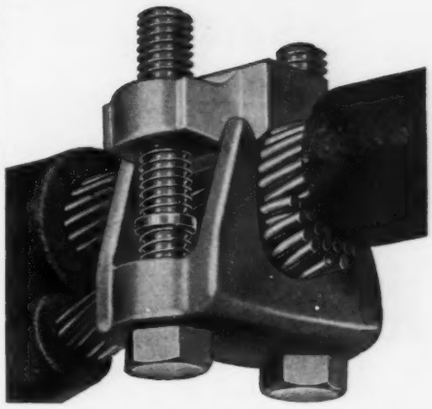
Commenting on the natural rubber supply picture, Mr. Viles stated that although the industry expected to use a larger proportion of natural rubber in 1946, in view of the apparently unexpected difficulties of progressive rehabilitation of Far Eastern producing areas, constant research would be devoted to the production of highest quality synthetic rubber products. Mr. Viles commented that he believed combinations of synthetic and crude in many products would perform outstandingly.

Although Mr. Viles conceded that the Rubber Study Group had estimated that in two or three years there might be a large surplus rubber capacity, he expressed optimism that the cost trend for both synthetic and crude rubber would be progressively downward to the point where world rubber demand would accelerate quickly, and large new uses could be confidently expected.

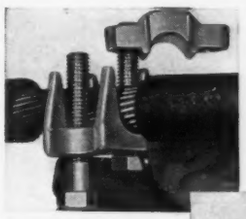
Mr. Viles stated that the rubber manufacturing industry felt keenly that it was necessary to maintain a strong synthetic rubber industry to insure national security. As Mr. Viles phrased it, "The United States must see to it, as a matter of broad basic policy, that we produce enough synthetic rubber to know how to make it better and how to use it better."

In concluding his statement, Mr. Viles said that he felt the Study Group meetings would tend to dispel the idea of a forthcoming war between the synthetic rubber industry and natural rubber producers for consumer acceptance in world

MATTHEWS UNICLAMP CONNECTORS

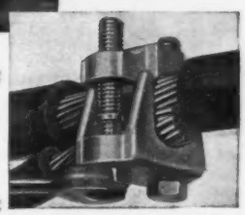


Made for use on copper or aluminum wires from 2/0 to 1000 MCM inclusive. They will connect two wires of their rated size or one wire of their rated size with one or more smaller tap-off wires down to No. 8 solid. They have many advantages over the larger sizes of connectors of the split bolt and other designs as they provide greater pressure between wires, hence greater holding power, are less costly, are easier to install and the assembled design is such that parts cannot become separated.



Fit on conductor as shown. Position top member and partially thread in free bolt.

Insert tap wire and equally draw up both bolts.



Write for Bulletin 206

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markets. Mr. Viles contended that once the "insurance of availability" of sufficient synthetic plant and sufficient synthetic rubber production was assured, the law of supply and demand would determine the amount of each to be used, and would insure the consumer progressively better products at progressively lower cost.

Attending the London conference with Mr. Viles were the following rubber industry representatives:

P. W. Litchfield, chairman of the board, Goodyear Tire & Rubber Co.; Harvey S. Firestone, president, Firestone Tire & Rubber Co.; John L. Collyer, president, B. F. Goodrich Co.; George M. Tisdale, vice-president, United States Rubber Co., and H. Stuart Hotchkiss, chairman of the board, Cambridge Rubber Co.

•

Ship 243,000,000 Electric Lamps in Third Quarter

Shipments of bulbs by electric lamp manufacturers in the third quarter of 1945 totaled 243 million, valued at $30.2 million, the Bureau of the Census, Department of Commerce, has announced.

Of the 243 million total, 229 million were domestic shipments, valued at $28.4 million, and 14 million were export shipments, valued at $1.8 million. Shipments of 167 million large and miscellaneous lamps were valued at $25.3 million and shipments of 76 million miniature lamps were valued at $4.9 million.

G-E Releases First Farm Stock-Tank De-Icers

First production lot of the new floating stock-tank de-icers has been shipped to authorized distributors and agents, according to G. A. Rietz, manager of General Electric's farm industry division, Schenectady, N. Y. The first of a number of new electrical products expected to be made available for farm use, the de-icer provides livestock with drinking water during the cold winter months by keeping a hole open in the ice forming on the surface of outside tanks.

The de-icer heating element operates at 120 volts, draws 300 watts and consumes about 500-kw.-hr. during a normal winter season. The device consists of a hollow, 20-gage, nickel-plated copper float, a thermostatically-controlled Calrod heating element, and a 5-ft. rubber-covered, water- and weather-resistant lead. The float is approximately 2½ in. in depth and 10¾ in. in diameter.

•

Kerite Changes Name

The company name, The Kerite Insulated Wire & Cable Co., was changed to The Kerite Co. by a resolution adopted at a stockholders meeting on October 10, 1945, and a certificate was filed and approved in the office of the Secretary of State of Connecticut on that date. The change was made to simplify the company name and entails no change in management or policy.

NO. 1 BANQUET COMPLETED—First post-war Electromaster range comes off the production line as sales and production executives look on. Reading from left to right, R. B. Blanchard, director of advertising; E. D. Gartha, Superintendent; E. J. Heinrich, service manager; H. H. Hubbard, vice-president in charge of manufacturing; E. R. Genthe, secretary-treasurer; and Gerald Hulett, vice-president in charge of sales, watch R. B. Marshall, president, check the first completed range. Production is being restricted to two models—the Banquet (shown on the final assembly line), and the Space-Saver—to achieve maximum output in the least time

Field Reports on Business

Reports from the field indicate that inventories of electrical equipment are near an all-time low. The shortage in electrical appliances remains acute. Inquiries for power equipment are encouraging and important among them are small turbo-generator units. Government buying is declining.

NEW ENGLAND

With inventories of electrical equipment near an all-time low and an acute shortage in electrical appliances adding further disappointments in the electrical trade during the past week, nevertheless announcements of many projects that are to materialize in 1946 are appearing frequently now and lend a very encouraging note to the trade.

New Haven Railroad plans to buy 180 air-conditioned passenger cars at a cost of $13,500,000. These cars will be equipped with many new features which involve sizable electrical equipment orders for lighting, control, and air-conditioning apparatus. Facilities for freezing food for domestic consumption are gaining attention in this area.

Inquiries for power equipment are encouraging and negotiations for small turbo-generator units are moving ahead rapidly. Tewksbury (Mass.) State Hospital is advertising for a 500-kw. unit and will install it as soon as available. A $250,000 foundry will be built in Fitchburg, Mass., by Magnus Metals, division of National Lead, and post-war planning by FWA last week allotted funds for projects which are estimated to cost approximately $1,800,000.

Government buying is declining: bids were tendered for small lots of friction tape, capacitors, signal control cable, thermoplastic insulated wire, and safety switches. A near-high record of applications for wiring permits was registered in Boston last month, pointing to activity in illuminated sign erection, changes in factory power layouts, and increasing installations of oil burners.

Massachusetts business incorporations now being filed show more than treble the normal rate at this time with a diversification of manufacturing planned in machine tools, electronic control sales, and appliance sales of more than passing interest as indicating optimism in the 1946 electrical market.

A $6,000,000 housing project involving the construction of 400 dwellings in Worcester, Mass., has been announced. Harry M. Ramsay, Boston, is the architect.

CHICAGO

Starting the first of the year, electrical contract labor in the Chicago area went to work at a new wage scale of $1.97½ per hour on all new jobs, although unfinished projects continue at the old rate of $1.85. The raise, which applies to all non-federal work, was granted by the Wage Adjustment Board at the request of the Electrical Contractors Association and Local Union B-134.

There is more electrical work in the area than contractors can possibly handle. It is estimated that there are 500 unfilled jobs in lighting alone. The high level of lighting in war plants made workmen and management both light-conscious as never before. Better illumination, despite its added cost, is desired by management because it increases efficiency.

A survey by the Purchasing Agents Association of Chicago, based on replies from 400 representative firms, discloses that this area is reconverting much faster than is the nation as a whole. Production rose 5 percent during November here, but dropped 4 percent throughout the nation in the same period. While the national index of production is down to 150 percent from a high of 247 percent in October, 1943, and is still dropping, 30 percent of the Chicago area firms, reporting as of November 30, said production was higher, 51 percent said it was the same, and only 19 percent reported it lower than it was October 30.

Reconversion is being eased by electrical contractors here, in line with national AFL recommendations, by a special rate of time and one-half for time over 40 hours per week or 8 hours per day, instead of double-time, as formerly. This applies only to work done in an area previously used for war work by a going concern.

PACIFIC COAST

The total value of building permits in the seven western states during November was $54,908,961, an increase of 18 percent over the previous month and of 350 percent over November, 1944. California and the interior states considerably exceeded this average. California has long led all other states in rural electrification and by the end of 1946, the Pacific Gas & Electric Co. will have added 3,000 more miles of rural distribution lines and 10,000 customers to its system, making northern and central California farms nearly 100 percent wired. The program will cost $6,000,000.

City of Pasadena is calling for bids on a 35,000- or 40,000-kw. turbine and appurtenances, at estimated cost of $800,000; preparatory work for installation of second generating unit at Fort Peck, Mont., has been awarded for $518,000.

Private housing includes such major tracts as Westchester in Los Angeles with 200 homes, costing $1,200,000; 38 two-story four-family apartments in Pasadena and a proposed $3,000,000 apartment and 1,000-car underground garage in Berkeley in East Bay area. Electrical items for such installations, while exceedingly scarce along the coast just now, are expected to arrive in sizable quantities by early 1946.

NEW YORK

The level of industrial output remained last week at the high level of previous weeks, but snow storms in the East added to the factors which were already hindering shipments.

Civil engineering construction volume in continental United States totaled $26,258,000 for the three-day week, ending December 27, 1945, as reported to *Engineering News-Record*. This volume was 59 percent below the volume for the preceding week, but was 13 percent greater than the volume for the corresponding week of last year. The week's construction terminated the total cumulative figure for 1945 at $2,289,408,000, which was 32 percent greater than 1944's cumulative figure of $1,729,753,000.

With the pace of buying continuing unchecked up to virtually the last minute, Christmas trade in the Metropolitan area and throughout the nation hung up new records for dollar volume. Indications are that year-end inventories will prove to be the lowest in many years.

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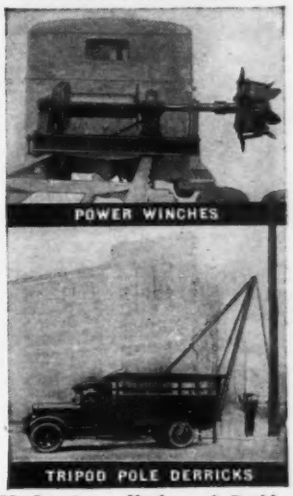

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Sales Opportunities

CALIFORNIA—Bureau of Power and Light, Los Angeles, has plans for auxiliary service buildings, including electrical work, at Harbor generating station, Wilmington. Call for bids is scheduled to be made at once (Specifications No. 9186).

NORTH DAKOTA—State Board of Higher Education, Capitol Building, Bismarck, will receive bids until January 21 for equipment for installation in power plant at State Teachers' College, Valley City, including steam turbine-generator, motor-generator set, switchboard and accessories, all as per plans and specifications on file. Jesse B. Harris Co., Wesley Temple Building, Minneapolis, Minn., is consulting engineer.

MINNESOTA—American Crystal Sugar Co., Boston Building, Denver, Colo., plans new beet sugar mill at Moorhead, including several multi-story buildings for processing and general production, with machinery and electrical equipment. A power plant is planned. Also number of structures for miscellaneous service. Cost reported about $2,500,000. Proposed to carry out project early in 1946.

NEW YORK—Consolidated Edison Co., New York, has plans maturing for alterations and improvements in Sherman Creek generating station, Harlem River and 201st St., including certain changes in present facilities. Proposed to carry out work soon. Cost reported close to $150,000.

KANSAS—Municipal Water and Light Dept., Colby, plans extensions and improvements in power plant and waterworks station, with installation of equipment for increased capacity. Cost estimated about $150,000. Proposed to arrange bond issue.

GEORGIA—Crown Cork & Seal Co., Eastern Ave. and Kresson St., Baltimore, Md., has plans in progress for new plant at Atlanta, comprising a main one-story building and several auxiliary structures, with machinery and electrical equipment for heavy output. A power substation and boiler house are planned. Entire project will cost about $2,000,000. Bids are scheduled to be asked soon on general erection contract. Robert & Co., Bona Allen Building, Atlanta, are architects and engineers.

NEBRASKA—Municipal Light and Water Dept., Wisner, plans extensions and improvements in power plant, including installation of new oil engine-operated generating unit and auxiliary equipment. H. S. Nixon, Grain Exchange Building, Omaha, is consulting engineer.

NEW YORK—Board of Water Supply, 120 Wall St., New York, will receive bids until January 15 for six electric hoists, two hoist motors, cable reel with electric cable, for use in connection with Shafts 6, 13 and 23 drainage chambers, Delaware aqueduct (Contract 356). Richard H. Burke, secretary.

ILLINOIS—American Steel & Wire Co., Rockefeller Building, Cleveland, Ohio, has authorized expansion and modernization in branch works at Waukegan for production of stainless steel wire, comprising several new buildings, with machinery and electrical equipment. Also will make number of interior improvements and changes in present plant units, with additional production facilities. Cost estimated about $1,000,000. Work will begin early in 1946 and is expected to require 12 months for completion.

IOWA—City Council, Pella, will receive bids until January 15 for equipment for municipal power plant, including (Section 1) metalclad switchgear equipment rated at 2,400/4,160 volts, for control of three generator and eight distribution feeder circuits, with complete auxiliary apparatus; (Section 2) indoor, load-center unit substation, rated at 2,400/4,160/460 volts, 250 kva., including enclosed switching equipment for control of station power circuits, all as per specifications on file. Brown Engineering Co., Valley Bank Building, Des Moines, is consulting engineer.

NEW MEXICO—Bureau of Reclamation, Denver, Colo., will receive bids until January 21 for four 1,000-kva., 110,000/34,000-volt single-phase, 60-cycle, oil-immersed, self-cooled, outdoor-type transformers, each with single-pole lightning arrester for 34,500-volt, three-phase ungrounded-neutral circuit mounted on case, for installation in power substation at Alamogordo, Rio Grande project, New Mexico-Texas. Equipment will be installed by government (Specifications 1140).

WISCONSIN—Dairyland Power Co-operative, Genoa, plans call for bids early in 1946 for proposed new steam-electric generating station at Alma, for which financing in amount of $3,500,000, has been arranged through federal aid. Vern E. Alden, 120 South LaSalle St., Chicago, Ill., is consulting engineer. Plans also are in progress for construction of about 250 miles of primary and secondary lines, with Stanley Engineering Co., Muscatine, Iowa, and Laramore & Douglass, Inc., 327 South LaSalle St., Chicago, consulting engineers, respectively, for different sections of system.

CALIFORNIA—Marchant Calculating Machine Co., Powell St., Emeryville, plans expansion in plant, including large one and multi-story addition, with machinery and electrical equipment for increased capacity. Cost estimated over $1,000,000. Project is scheduled to be started early in 1946.

ARIZONA—Bureau of Reclamation, Denver, Colo., will receive bids until January 22 for equipment for Davis Dam construction substation, Davis Dam project, near Kingman, Arizona-Nevada, including: Four 5,000-volt outdoor-type potential transformers; two 5,000-volt outdoor-type current transformers; four additional 5,000-volt latter-type transformers; one 7,500-volt, three-pole, single-throw, outdoor-type power circuit breaker; two 69,000-volt, three-pole, single-throw, manually gang-operated, outdoor-type disconnecting switches; one 7,500-volt similar switch; nine 7,500-volt, single-pole, single-throw hook-operated, outdoor-type disconnecting switches; six additional 7,500-volt similar switches; six 69,000-volt single-throw, hook-operated, outdoor-type, expulsion-fuse disconnecting switches, each complete with two fuse units; three two-element watt-hour indicating demand meters; and three outdoor, station-type lightning arresters. All equipment will be installed by government (Specifications 1138).

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New Department Formed

A new design-engineering service department has been formed recently by H. O. Canfield Co., Bridgeport, Conn., to assist electrical and general industrial equipment manufacturers in studying rubber and synthetic rubber usage in products.

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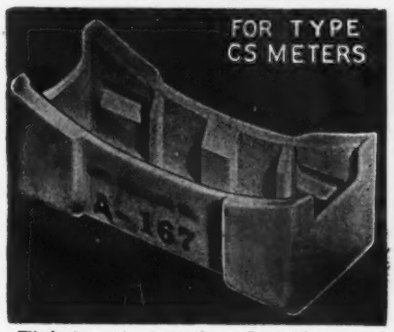

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Recent Rate Changes

JERSEY CENTRAL POWER & LIGHT CO. has agreed to reduce electric rates by $1,000,000 annually, effective early in 1946, the State Board of Public Utility Commissioners has announced. The reduction has been agreed to by the company as the forerunner of a program to scale down and refund its $21,861,500 of preferred stock. As part of the recapitalization plan the parent, NY PA NJ Utilities Co., will contribute $5,000,000 to Jersey Central Power's cash resources to help it to reduce its preferred stock to $12,000,000 par value. The recapitalization plan, when completed, will have to be submitted to the Securities and Exchange Commission.

EL PASO ELECTRIC CO. has been authorized to reduce rates to 4,000 domestic consumers in Las Cruces and Mesilla Valley communities to the amount of $17,222 annually, the State Public Service Commission has announced. The new rates, which already have been approved by the Las Cruces city government, are the same as those just announced for El Paso consumers—4.5 cents per kilowatt-hour for the first 50 kw.-hr.; 3 cents for the next 50 and two cents thereafter. The rate reductions became effective with the January 1 readings.

CENTRAL HUDSON GAS & ELECTRIC CORP. has been authorized by the New York Public Service Commission to reduce electric rates approximately $203,000 annually. The rate cuts, affecting some 77,000 customers in Beacon, Kingston, Newburgh, Poughkeepsie and other communities in the Hudson Valley, were initiated by the company. The utility's application showed that urban residential consumers would benefit to the extent of an estimated $52,000 annually. Rural customers will receive a reduction of about $49,000, while commercial and industrial users will save about $102,000 a year. The principal reduction is in the minimum charge, which will be cut from $1 to 75 cents a month in urban areas and from $1 to 95 cents in rural territory. In urban areas, however, the amount of electricity covered by the minimum charge is to be reduced from twelve to ten kilowatt-hours.

WESTERN MASSACHUSETTS ELECTRIC CO. reduced rates for residential and commercial customers January 1 in Franklin, Berkshire and Hampshire Counties. Residences will save from $5 to $7 per year each, on the average, and business houses will receive a rate of 2 cents per kilowatt-hour instead of 3.

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Standards Organization Broadened by G.E.

The transfer of General Electric's standards division from the apparatus to the executive department, with L. F. Adams as manager, has been announced by H. A. Winne, vice-president in charge of the company's engineering policies.

At the same time, Mr. Winne announced the establishment of the standards advisory committee with Mr. Adams as chairman, H. W. Robb as secretary and a representative from each department. The committee will work in collaboration with the standards division and is charged with responsibility in the determination of sound policies to guide internal and external standards activities.

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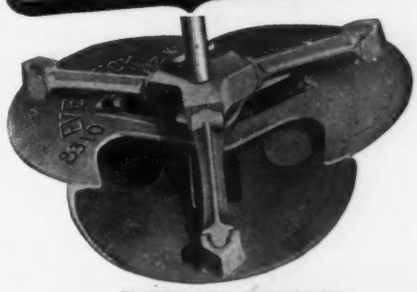

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ELECTRICAL TESTING LABORATORIES INC.

Field and Laboratory Tests
Electrical • Mechanical • Physical
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Expert advice on location and purchase of right of way.
Industrial plant layouts & surveys. Rate comparisons.

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Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

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WHITMAN, REQUARDT AND ASSOCIATES

ENGINEERS — CONSULTANTS
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1304 St. Paul Street Baltimore 2, Md.

REA Announces New Allotments

Rural Electrification Administration has recently announced approval of loan allotments totaling $3,927,000 to 26 co-ops in 14 states. Unless otherwise noted, the loans which are listed below will be used for line construction to extend electric service.

COLORADO—Union Rural Electric Assn., Inc., Brighton, $21,000 for headquarters facilities.

FLORIDA—Escambia River Electric Co-op., Inc., Jay, $67,000.

GEORGIA—Mitchell County Electric Membership Corp., Camilla, $320,000, which includes funds for improvements; Little Ocmulgee Electric Membership Corp., Alamo, $50,000.

INDIANA—Utilities District of West Indiana REMC, Bloomfield, $235,000; Harrison County REMC, Corydon, $85,000.

IOWA—Maquoketa Valley Rural Electric Co-op., Anamosa, $325,000, which includes funds for line conversion, construction of transmission line and purchase and installation of substation transformers; Farmers' Electric Co-op., Inc., Greenfield, $115,000; Gowrie Rural Electric Co-op. Assn., Gowrie, $8,000.

MICHIGAN—Southeastern Michigan Rural Electric Co-op., Inc., Adrian, $95,000, which includes funds for improvements to the system.

MINNESOTA—P.K.M. Electric Co-op., Inc., Grand Forks, N. Dak., $135,000; North Star Electric Co-op., Inc., Baudette, $100,000.

MISSOURI—Three Rivers Electric Co-op., Linn, $130,000; North Central Missouri Electric Co-op., Inc., Milan, $25,000.

NEBRASKA—Cornhusker Rural Public Power District, Columbus, $325,000; Cedar-Knox County Rural Public Power District, Hartington, $260,000.

NEW MEXICO—Farmers' Electric Co-op., Inc., Clovis, $137,000.

OREGON—Columbia Basin Electric Co-op., Inc., Heppner, $510,000; Tillamook People's Utility District, Tillamook, $100,000.

SOUTH CAROLINA—Bamberg Electric Refrigeration Co-op., Inc., Bamberg, $10,000, which with previous allotment will provide for construction of refrigerated locker plant.

TEXAS—Upshur Rural Electric Co-op Corp., Gilmer, $235,000; Fort Belknap Electric Co-op., Inc., Olney, $144,000; Wharton County Electric Co-op., Inc., El Campo, $110,000; Hall County Electric Co-op., Inc., Memphis, $75,000; DeWitt County Electric Co-op., Inc., Cuero, $40,000.

VIRGINIA—Powell Valley Electric Co-op., Jonesville, $270,000.

•

One-Fourth of War Vets Rejoin Lamp Division

Approximately one-fourth of the Westinghouse Lamp Division men and women who entered World War II have rejoined the company at its plants in Bloomfield, Trenton and Belleville, N. J., and Fairmont, W. Va., a survey showed.

"Of the 1,200 who left their manufacturing and office jobs to serve in the Armed Forces, 288 are back at work," reported William E. Short, staff assistant in the industrial relations department. He added: "In interviewing the returned men and women, we have found that because of their military training some of them qualify for better positions than before they went off to war. Where possible, the reassignments to these new posiions are made."

•

Hot Water Heater Trends Disclosed

Three trends encouraging to makers and sellers of electric water heaters—an increasing number of customers to whom suitable water heater rates are available, longer charging hours, and a substantial increase in the adoption of EEI-NEMA standards—are disclosed by a survey covering over 400 electric utilities serving some 23,000,000 domestic customers, soon to be released by the appliance department of General Electric Co.

The survey shows a national saturation of 4.1 percent; one company reported 63.2 percent and many others 20 to 40 percent. Over half (56 percent) of the meters covered by the survey are of companies selling or planning to sell water heaters; 27 percent will not sell but may promote and the remaining 17 percent are undecided or supplied no information on this point.

Prior to World War II it was generally accepted that 65 per cent of the country's domestic electric meters were served by an electric water heating rate of 1½ cents or below. This survey shows a total of 16,731,232 meters (or 72 percent) now served by these rates out of the total coverage of 23,273,156 meters.

As to charging hours, 36 percent of the replying utilities reported uncontrolled charging; 28 percent had 16 to 24 charging hours, 10 percent, 13 to 15 hours, 24 percent 8 to 12, and 2 percent used carrier and peak limiter control.

Before the war 129 companies, serving 7,348,792 domestic meters, sold EEI-NEMA Standard water heaters. Today 149 companies, serving 9,870,799 meters, sell or plan to sell EEI-NEMA Standard water heaters. This is a gain of 2½ million meters or 34 percent more than pre-war.

An additional 154 companies, serving 6,832,928 meters, will permit water heaters meeting these standards to be installed on their lines. Thus, a total of over 16 million, or 72 percent of the meters covered by this survey, are served by companies either selling, promoting or permitting EEI-NEMA Standard water heaters.

There is a decided trend towards nonferrous tanks. Areas in which galvanized tanks were exclusively used or largely predominated (100 to 80 percent) contained 62 percent of all the electric customers prior to the war. Now those areas have shrunk and they contain only 37 percent of the customers.

SEARCHLIGHT SECTION

(Classified Advertising)

Employment : : Equipment
Business : : Used or Resale

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15 CENTS A WORD. MINIMUM CHARGE $3.00

Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.

Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.

Discount of 10% if full payment is made in advance for 4 consecutive insertions.

DISPLAYED RATE

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $7.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

POSITIONS VACANT

(Additional Positions Vacant ads on page 140)

WANTED A man under 40 to take the position of Assistant Superintendent of Production in an electric utility company having a generating capacity of about 50,000 k.w. Should have mechanical engineering training and experience in steam power plant operation and maintenance and in the handling of men. There is a splendid opportunity for advancement as the situation is growing rapidly. P-144, Electrical World, 330 W. 42nd St., New York 18, N. Y.

WANTED: ELECTRICAL Engineer. Must be experienced in design of small power transformers. Excellent opportunity for right man. Large national manufacturer. Location Southeastern states. P-152, Electrical World, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 140)

WANTED

DESIGNERS

ARCHITECTURAL
STRUCTURAL
POWER PIPING
ELECTRICAL

5 to 10 yrs. experience required in Power Plant or Heavy Industrial Structures. Positions in Philadelphia

United Engineers & Constructors Inc.
1401 Arch St. Phila. 5, Pa.

WANTED

General Plant Superintendent

Power Company operating interconnected system with numerous plants in three states in North Central United States is looking for experienced man, age 40 to 50 years, to supervise operation and maintenance all plants. Must be executive type with technical training in combustion and mechanical engineering and broad operating experience in steam power plants. Diesel and water power experience desirable. Headquarters in city of 12,000. Considerable traveling around territory necessary. Permanent and highly responsible position with locally controlled and operated Company for right man. Applicants should state complete history of experience and education, previous positions held and duration, with reasons for changes. Include photograph and references. State salary expected.

OTTER TAIL POWER COMPANY
Fergus Falls, Minnesota

WANTED

ELECTRICAL DESIGNERS

Experienced in
DESIGN of POWER & INDUSTRIAL PLANTS
Location N. Y. City

EBASCO SERVICES INC.
2 Rector St. N. Y. C. 6

NEW INSULATED MAGNET WIRE

Item No.	Size	Description	Approx. Weight
22585	.072" (#13 Awg.)	Triple Cotton Covered, Round	235#
22586	.072" (#13 Awg.)	Asbestos Insulated, Reels	134#
22587	.081" (#12 Awg.)	Single Glass Covered, Round	2,000#
22588	.081" (#12 Awg.)	Single Glass Covered, Round	685#
22591	.049" x .437"	Double Cotton Covered, Rect.	645#
22592	.051" x .114"	Double Glass Covered, Rect.	1,530#
22593	.051" x .325"	Double Cotton Covered, Rect.	499#
22595	.057" x .365"	Double Glass Covered, Rect.	493#
22598	.064" x .325"	Asbestos Insulated, Rect.	130#
22599	.064" x .365"	Asbestos Insulated, Rect.	958#
22604	.102" x .289"	Asbestos Covered, Rect.	604#
22605	.102" x .325"	Double Glass Covered, Rect.	7682#
22606	.106" x .256"	Double Glass Covered, Rect.	180#
22615	.182" x .289"	Double Cotton Covered, Rect.	672#
618	.100" x .400"	Double Glass Covered, Rect.	1,074#
619	.035" x .155"	Double Vitreous	1,681#
620	.070" x .250"	Double Vitreous	4,726#
621	.110" x .185"	Double Vitreous	3,160#
622	21 Awg.	Single Vitreous	2,700#
624	17 Awg.	Double Cotton Covered, Enameled	7,000#
625	34 Awg.	Triple Formvar	1,469#
26286	.0005" (#36 Awg.)	Enameled Dbl. Scrape Hardness	150#
26287	.1113" (#29 Awg.)	Single Glass Covered	338#
26290	.0201" (#24 Awg.)	Enameled Syn.	1,466#
26292	.036" (#19 Awg.)	Single Cotton Covered Enameled	755#
26293	.0403" (#18 Awg.)	Asbestos Insulated	209#
26294	.057" (#15 Awg.)	Enameled with one rap of Manila Rope Paper	15,374#
26297	.32" x .365"	Double Glass Covered	8,045#
26298	.040" x .365"	Double Glass Covered	4,184#
26299	.063" x .625"	Double Cotton Covered	265#
26300	.081" x .289"	Double Glass Covered	2,184#
26301	.091" x .124"	Double Cotton Covered	231#
26304	.102" x .258"	Double Glass Covered	2,189#
26305	.114" x .289"	Double Glass Covered	1,515#
26306	.129" x .258"	Double Glass Covered	1,687#
26307	.129" x .289"	Double Glass Covered	1,757#

DULIEN STEEL PRODUCTS, INC.
2280 WOOLWORTH BLDG. N. Y. 7, N. Y.
Tel. Cort. 7-4676

FOR SALE

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two new Westinghouse 400 HP vertical motors: squirrel cage. 2200 volts, 3 phase, 60 cycle, 10 pole, 708 RPM. vertical solid shaft, external thrust of 20,000 lbs. Weatherproof construction including thermoguards. 3 issues only. For details and attractive price, write wire, or call

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FOR SALE

- 1—3 phase, 60 Cycles Type TRC, 60 KVA, 2300 Volt 257 RPM Alternating Current Generator.
- 1. Type RC Belt Driven 5 KW, 125 volt 40 Amp. 1150 RPM Direct Current Exciter for above. Rheostats for both included.
- 1. 200 gallon per minute at 120 ft. head Dayton Dowd, Direct connected Centrifugal Pump. This pump is direct connected to a GE 15 HP 220-440 Three Phase 1750 RPM Motor
- 1. GE 15 HP 220-440 Volt Three Phase, Type FTR 1165 RPM Motor

Above equipment will be shipped FOB Adel, Ga. For information on the above, write, wire or phone

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Supt. Light & Water Dept.
City of Adel, Georgia

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SALES ENGINEERS

Graduate Electrical Engineers, familiar with low voltage distribution systems to act as sales specialists in important District Offices on following: Panelboards, safety switches, enclosed circuit breakers, bus duct and load centers. Men accepted to receive full training at factory at company's expense before assignment. Write to Manager, Technical Employment, 306 Fourth Avenue, Pittsburgh, Pennsylvania, for application form.

WESTINGHOUSE ELECTRIC CORP.

Export Corporation

Has opening for specialist in Electrical Equipment and Supplies and Appliances, as

DEPARTMENT MANAGER

Must have contact with manufacturers. Give details, experience and compensation desired.

P-150, Electrical World
330 West 42nd St., New York 18, N. Y.

WANTED

Young Electrical Engineers

For work in Engineering Department of Electric Utility Company. State full details as to experience.

OTTER TAIL POWER COMPANY
Fergus Falls, Minnesota

(Continued from page 139)

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. Reconversion is creating lifetime opportunities now. This thoroughly organized confidential service of 35 years' recognized standing and reputation carries on preliminary negotiations for supervisory, technical and executive positions of the calibre indicated, through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

PUBLIC UTILITY Engineer graduate E.E., age 40, married, 17 years experience in public utility, operation, rates, power sales, engineering, appraisal and construction, offers service to consulting engineering firm. Excellent references and employee relation record, now connected with large utility. Available on reasonable notice. PW-145, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

PLANT ELECTRICAL Engineer, fourteen years experience in design, construction, testing, and maintenance of industrial electrical installations with leading steel and by-product coke manufacturer and shipyard. Desires similar position with progressive firm. PW-153, Electrical World, 330 W. 42nd St., New York 18, N. Y.

CORNELL GRADUATE, EE-ME: GE student course; 25 years experience in the various but related fields of hydroelectric & irrigation projects; electric railroading; electric steam boilers; machinery for many types of industry; extensive electro-physical laboratory research; technical glass work; high vacuum technique; induction and arc furnace operations; development of complicated instruments and patents. Proficient in preparation of engineering reports. PW-154, Electrical World, 68 Post Street, San Francisco 4, Cal.

SALES ENGINEER: B.S. in E.E. with 20 years sales experience in selling electrical and mechanical equipment. Dealing with southern utilities, industrial plants, architects and designing engineers. Field officer being released from the Army Air Forces and desires position. Married—one child. Will go anywhere in states. PW-155, Electrical World, 330 W. 42nd St., New York 18, N. Y.

WANTED

ANYTHING within reason that is wanted in the field served by Electrical World can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.